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ABSTRACT

The document contains 12 papers. Two of the papers present opening and closing remarks to the conference. The other 10 deal with their State's management information system (MIS) in vocational education. The 10 papers are clustered according to whether they are primarily descriptive of student accounting (four papers), manpower supply and demand subsystems (four papers), or financial accounting and resource allocation subsystems (two papers). Because the purpose of the conference was to provide descriptive information on the development and operation of the selected exemplary systems, participants were requested to conform as closely as possible to a four-part outline in their presentations: (1) the relationship of the subsystem of interest to the total MIS,(2) the objectives and structure of the subsystem, (3) who and what the subsystem is designed to serve (and who uses it), and (4) a description of the process of the subsystem. Selection of the States to be represented was made by a steering committee on the basis of a three-point criteria. The States were: Kansas, Minnesota, Oklahoma, New Jersey, Pennsylvania, Virginia, and Wyoming. Summaries of the 10 papers are included. (Author/AG)

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MANAGEMENT INFORMATION SYSTEMS for VOCATIONAL EDUCATION:

A NATIONAL OVERVIEW

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STATE M I S SUBSYSTEMS REPORTED:

STUDENT ACCOUNTING -
MINNESOTA, OKLAHOMA, PENNSYLVANIA, VIRGINIA

MANPOWER DEMAND/SUPPLY -
KANSAS, MINNESOTA, OKLAHOMA, PENNSYLVANIA

FINANCIAL ACCOUNTING & RESOURCE ALLOCATION -
NEW JERSEY, WYOMING

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DASP

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Dynamic Analysis and Strategic Planning is a Program Division of the Center for Occupational Education at North Carolina State University. DASP is committed to a systematic application of information technology to the identification, collection and provision of management information for educational decision-makers. The program currently has two major thrusts: (1) research and development aimed at improved information technology and strategies for agency implementation, supported by an NIE contract; (2) application of the developed information technology to field generated problems, supported by independent contracts with interested client groups.

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MANAGEMENT INFORMATION SYSTEMS FOR VOCATIONAL EDUCATION: A NATIONAL OVERVIEW

Technical Report No. 1

Edited by

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DASP Program Division
Center for Occupational Education
North Carolina State University at Raleigh

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PREFACE

The suggestion for a national exchange of information on the state-of-the-art of vocational education management information systems was first advanced in a planning conference sponsored by the DASP Program Division of the Center for Occupational Education. Early in our attempts to implement this suggestion, we discovered that the Oklahoma State Department of Vocational and Technical Education had a similar interest. The present document is therefore the result of a joint effort on the part of both organizations.

Special recognition is due to the editors for their endeavors to ensure standardization of report content, to Dr. Francis Tuttle for his gracious hospitality, to Drs. William Stevenson and John Struck for delivering seminal opening and closing papers, to all members of the steering committee for their knowledgeable advice, to the individual authors for their diligence in describing their systems, to Dr. Lloyd Briggs for his supervision of conference logistics, and finally to the Center program staff in the preparation of the final manuscript.

D. W. Drewes, Director
DASP Program Division
Center for Occupational Education

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INTRODUCTION

JOHN E. S. LAWRENCE

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INTRODUCTION

The Vocational Education Act of 1963 mandated states to gather information supportive of their state plan. During the intervening decade, a variety of responses to this mandate have evolved. Some states have developed highly sophisticated information reporting and analysis systems while others have been content to confine their efforts to the development of minimum requirement systems. Between these extremes are those states that cannot afford the resource costs associated with the design, development, or maintenance of complex information systems yet desire to expand their information handling capabilities beyond that required for compliance reporting. Were relevant documentation readily available, these states could profit from the experience of states that already have exemplary operating systems. It is to this purpose that the National Conference on Management Information Systems in Vocational Education was conceived. The conference was jointly sponsored by the Oklahoma State Department of Vocational and Technical Education and the DASP Program Division of the Center for Occupational Education, and was held at the Sheraton (Airport) Hotel on November 14-16, 1973.

Selection of exemplary states to be represented at the conference was made by a steering committee consisting of: Walter M. Arnold, Walter Arnold Associates, Inc.; Lowell A. Burkett, Executive Director, American Vocational Association, Inc.; Charles H. Buzzell, Associate Commissioner of Planning, Occupational and Adult Education, U. S. Office of Education; Laurence Kahn, National Advisory Council on Vocational Education; Arthur M. Lee, Director, Project Baseline, Northern Arizona University; and Otto Legg, Deputy Director, U. S. Office of Education. William W. Stevenson, Assistant State Director, Oklahoma State Department of Vocational and Technical Education, served as chairman. The selection criteria were the following:

1. a state information system must have at least one unique aspect in order to qualify,
2. the information system must have been operational for at least one year, and
3. no more than twelve states could be selected due to scheduling limitations.

Based on these criteria, the states of Kansas, Minnesota, Oklahoma, New Jersey, Pennsylvania, Virginia, and Wyoming were invited to present papers descriptive of their systems.

This report contains the twelve papers presented at the conference. Ten of the papers dealt with the operating systems, the other two with opening and closing remarks. The ten papers dealing with operating systems are clustered according to whether they are primarily descriptive of

(1) student accounting subsystem (four papers), (2) manpower supply and demand subsystems (four papers), and (3) financial accounting and resource allocation subsystems (two papers). These classifications were developed by the steering committee as a means of ensuring comprehensive coverage. Summaries of each paper are presented for the convenience of those who desire a brief overview of the respective system.

Because the purpose of the conference was to provide descriptive information on the development and operation of selected exemplary systems, considerable efforts were made to maintain similarity of format for all system descriptive papers so as to facilitate comparison across systems. Participants were, therefore, requested to conform as closely as possible to the outline shown in Figure 1.

OVERVIEW OF THE TOTAL MANAGEMENT INFORMATION SYSTEM

  Historical Development
  Organization and Design
  Current Capabilities and Future Plans

OVERVIEW OF THE SUBSYSTEM OF INTEREST

  Objectives
  Organization
  General Description

RELATIONSHIP OF THE SUBSYSTEM TO DECISION-MAKERS

  Determination of Information Needs
  Utilization of Information

OPERATIONAL DESCRIPTION OF THE SUBSYSTEM

  Input
  Output
  Resource Requirements

GENERAL DISCUSSION AND CRITIQUE OF THE SUBSYSTEM

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Figure 1. Outline Format for Conference Papers

The outline addressed four central concepts: (1) the relationship of the subsystem of interest to the total MIS, (2) the objectives and structure of the subsystem, (3) who and what the subsystem is designed to serve (and who uses it), and (4) a description of the process of the subsystem. Each concept served as the subject of a section of the paper.

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In the first section, the authors were asked to introduce the total MIS, briefly explaining its past development, present organization, and future expectations, thereby establishing the context for the particular subsystem of interest. Following this, the subsystem objectives and organization are explained, along with a general description of the subsystem structure. The third section relates the purposes of the subsystem to the needs of users, and the fourth describes the process of the subsystem, its inputs, outputs, and resource requirements in some detail. A critique was included in most but not all papers.

Dr. William Stevenson, in his opening paper, noted the steadily increasing information load on education decision-makers and the resultant new look at information processing techniques in state departments. However, warning against possible over-reliance by administrators upon information specialists, he urged that they remain sensitive to the views of a variety of constituencies. Finally, he expressed the hope that emerging information systems be flexible enough to continue to adapt to the changing demands of complex administration.

The four papers on student accounting introduced operating systems in four states--Minnesota, Oklahoma, Pennsylvania, and Virginia.[1] There are several overall commonalities shared by these states, both in the reasons for development of their MIS and in their systems' operation in areas of student enrollment, completion, and follow-up. A prime motivation for initiation of automated student data processing has been the expressed need for better information for decision-makers, and thus by implication, dissatisfaction with the time-consuming clerical toil and resulting inconsistencies associated with previous methods. Federal legislation during the sixties undoubtedly stimulated growth in the sophistication of techniques as did emerging public pressure for accountability in education. Particularly strong arguments for centralization of vocational follow-up systems are put forward by Pucel (pp. 17-18) and McHenry (pp. 84-85), indicating cost-benefits and an increase in the ability to provide answers to awkward questions. Follow-up efforts in vocational education appear also in the past to have been plagued by duplicate reporting, a problem at least partially solved in the computerized systems described.

Comparisons of systems across states also yield important ways in which they differ. Some of the more salient differences between MIS in these four states are manifested, for example, in operating costs, information content, and methodologies for data gathering. Insofar as it is possible to compare meaningfully the costs[2] of operating the student follow-up systems across states, these costs vary considerably. Amounts range from $15,000 to $117,000 per annum. In some cases (e.g., Virginia), resources required to develop the system were more than are presently needed to operate it. Only two authors go so far as to break down costs to a per-student figure; this is calculated at 16¢ per student for Oklahoma and 11¢ per student for Pennsylvania. Estimates of absolute numbers of students processed, however, are vastly different; for Pennsylvania the number is projected at 800,000 students per year, as compared with 97,000 for Oklahoma.

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[1] The reader is also referred to a brief description of the student accounting system in Kansas, in J. L. Harris, The Kansas Manpower Utilization System for Training (Manpower Demand Module), p. 144, which is included in this conference report.

Types of information gathered on students differ, as may be confirmed by examining the data collection forms appended to the back of each paper. The questions, for example, on the Minnesota enrollment form (Pucel, pp. 23-24, 41-42) are far more detailed than those on the Virginia enrollment form (Vivekananthan and Oliver, p. 124). Methods of data collection also vary, primarily in the source of data (teachers, students, or employers) and in whether or not the OPSCAN format is used to collect data in machine readable form. Table 1 documents the comparison, for all four systems, between sources of data (students or teachers) and method of input to the computer (i.e., direct or indirect). Neither Minnesota nor Oklahoma relies on machine readable forms as input to their systems, while Virginia does partly, and Pennsylvania entirely. Similar variations exist in the extent to which states rely on students or employers as sources of student follow-up data. It should be noted that while Oklahoma uses teachers exclusively as their source, ex-students are sampled directly for follow-up data every three years, and Oklahoma has made extensive use of employers as sources of data elsewhere in their system. (See J. B. Morton, Occupational Training Information System [OTIS], pp. 194-196, 199, presented to the conference and included in this report.)

States contributing to the section on manpower supply and demand systems are Kansas, Minnesota, Oklahoma, and Pennsylvania. The systems described in the four papers on this topic do not all fit the format prescribed for the conference quite as neatly as the papers on the student accounting. This is true for a variety of reasons, among which are the diversity of sources required to generate meaningful manpower data, and thus the multiplicity of agencies at the state level responsible for the management of such information. Thus in Minnesota, for example, though the State Division of Vocational-Technical Education is responsible for the operation of four subsections concerned with programmatic development and budgeting, implementation, evaluation and manpower development

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[2] It is important to note that cost figures cited for various systems may have been computed in different ways. While some systems include all operating costs in their gross figure, others refer only to those costs coming out of the office in which the project is administered. In the latter case, some clerical and computer costs may not be reflected in the gross figure, because they are absorbed by local schools or by state agencies (Pucel, p. 39).

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Table 1. Sources of Enrollment, Completion and Follow-Up Data by State and Format

STATE	FORM	SOURCE	METHOD OF COMPUTER INPUT
Oklahoma	Enrollment Form	Teacher	Keypunch
	Completion Form	Teacher	Keypunch
	Follow-Up Form	Teacher	Keypunch
Minnesota	Enrollee Information Form	Student	Keypunch
	Termination Report Form	Teacher	Keypunch
	Follow-Up Questionnaire	Ex-Student	Keypunch
	Employment Questionnaire	Employer	Keypunch
Virginia	Student Enrollment	Students & Teachers	OPSCAN
	Program Termination or Completion Form	Teachers	Keypunch
	Follow-Up Form	Ex-Students	Keypunch
	Adult Enrollment	Teachers	Keypunch
Pennslyvania	Student Registration Form	Student	OPSCAN
	Year-Start Roster Form	Teacher	OPSCAN
	Year-End Status Roster Form	Teacher	OPSCAN
	Follow-Up Form	Ex-Student	OPSCAN

and training, each subsection is independently operated, and cannot be considered as a subcomponent of a homogenous MIS in the same way as, for instance, Oklahoma's subsystems.

Furthermore, the cost of manpower supply/demand information systems is not readily forthcoming in two of the four states. In Pennsylvania and Minnesota, the annual operating costs are not yet finalized, though limited data on salaries are available in Pennsylvania. (Senier and Franchak, p. 221.)

In one case (Oklahoma) where the papers on student accounting and manpower supply were written by the same author, the initial chapter overviewing the total system is, of course, identical in both papers.

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Some major differences between approaches across these four states include (1) the extent of variety in uses to which system outputs are directed, (2) whether or not higher education is involved as well as vocational education in collecting and using the manpower data in the system, and (3) methods used to develop present systems.

Regardless of these analytical differences, however, it is clear that the need for accurate manpower data in improved statewide planning was both felt and expressed, and provided strong encouragement for the design and development of each of the four systems described. It is also apparent that some problems are shared by more than one of these states, notably in the areas of scope and accuracy of projection data. Both Morton (p. 198) and Johnson (pp. 171-172) have referred to the problems of generalizing from statewide data to the local level. Statewide data for the local-level planners are analogous to national data available to a state planner; that is, necessary for overall context, but not sufficient for specific decisions at the level of program implementation. Geographic mobility of the labor force between and across occupations (Johnson, pp. 171-172 and Senier and Franchak, p. 233) is difficult to track. Kansas has noted (Harris, pp. 163-164) the problem with the identification of emerging occupations in systems whose classification schemes are historically based. Harris further indicates (p. 164) the potentiality for confusion in system discrimination between related occupations, such as for example, "machinist" and "machine tool operator."

In general, it seems that techniques exist at present in several states in the nation which permit at least rudimentary solutions to the problems of estimating manpower supply and demand. Projections, while still liable to varying degrees of error, are coming increasingly within tolerable confidence limits, and reliance upon them is presently more satisfactory to planners than, for instance, on the traditional optimism of employers, or even on more objective data available only at the national level. It is also clear that in the coordination of manpower projections and educational planning, vocational education, for a number of reasons, leads the educational field. The inclusion of higher education input into, and use of, the Pennsylvania system is therefore particularly interesting.

The third and final section is that dealing with financial accounting and resource allocation systems in New Jersey and Wyoming. Because costing information has been in constant demand by those responsible for both allocation to, and administration of public monies in education, most states have had some kind of financial accounting system in operation for many years. Not only have these systems perenially supplied answers to important questions from decision-makers, but in some cases (e.g., Oklahoma) general information systems have grown directly out of the computerization of the SEA's accounting system. Thus, it is not surprising that the authors of these two papers--the final two papers in the main body of the conference--offer some valuable commentary on management information systems in general. Dr. Weiss, in his discussion section, provides some thoughtful observations on seldom voiced consequences for internal management of the new techniques. In his introductory overview, Dr. Fox

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addressed some of the issues, historical and current, facing information systems in general and accounting systems in particular. National development in the accounting systems of state educational agencies has been guided predominantly by USOE publications in the Educational Records and Reports Series, culminating in the recent revision of Handbook II in late 1973.

Although the ten systems described at the conference have begun to solve some of the problems facing planners in the respective State Vocational Education Agencies, they have also raised some new issues of their own. Their architects designed them to produce data in meaningful form for decision-makers. Nowhere in the system, however, is there a substitute for the action of the decision-maker. It is important that the masses of data presently being generated do not merely stagnate, but are disseminated in such a way as to extract from them the maximum benefits possible. Dr. John Struck, in his closing paper, vigorously emphasized the need for state and local vocational administrators to do something useful with the data now being provided. He itemizes, and briefly evaluates some of the tools of network planning analysis and management available to carry out this task. While commending the developmental work already performed on existing MIS, he urges that similar efforts now be put into the application of information to improve decisions in vocational education planning and implementation.

Conference participants generally agreed that there was a definite need for wider dissemination of information about information systems and for continuing dialogue between information users. As might be expected, more issues were raised than answers. Perhaps the most salient consideration was identified by Struck regarding the search for ways to put all this recently gathered information to optimum use. Above all else, however, the conference papers provided ample demonstration of one thing. Technologies are currently available for comprehensive data-handling at the state level. Vocational education now has the technical capability to design, develop, and implement information systems. Whether these systems are truly management information systems in the sense that they contribute to the improved management of vocational education is yet to be answered.

THE PRODUCT AND THE PACKAGE

WILLIAM W. STEVENSON

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There has been in the past decade a rapid increase in the amount of information and data required for decisions relating to programs of vocational and technical education. Concomitantly, there has been a rapid increase in the amount of information and data which could be made available to decision-makers in vocational and technical education. The rapid expansion of programs, the wide diversity of programs, and the flexibility required of State Departments to move in the direction indicated by the need have vastly complicated the responsibility of state leaders in vocational and technical education. A few years ago, decisions facing administrators of programs were relatively simple in that they consisted primarily of the allocation of resources to a relatively few traditional programs of training. That set of alternatives has increased so rapidly and the complexity of the choices which are available has so increased that the administrator is now faced with a myraid of decisions unthought of only a few years ago. The choice now is not only between the traditional subject matter divisions but has been expanded to levels of secondary, postsecondary, and adult, and has further been complicated by alternatives which include short-term programs, programs of longer duration, and one-shot skill training programs for industry. Cutting across all of these possible decisions is the further mission of the programs to develop special sensitivities to disadvantaged, handicapped, and underemployed and unemployed. These complicating circumstances matched with increased numbers of students to be trained, increased resources to be allocated, and greatly increased knowledge about the learning process have placed additional stress and importance on the quality of decisions made regarding programs in vocational and technical education.

Obviously, there is a need for more information, but the problem is much more complex than this. This information must be current; this information must be accurate; this information must be available and in the form in which it is understandable and acceptable; this information must be combined, molded, and mixed in ways which are meaningful to administrators. This information must be packaged so that its application to immediate problems is readily apparent. If information is to be used, all of the recent research indicates that it must be readily available. Information-seekers do use information in their decision-making process but only that which can be obtained at the time and in the form that is needed.

Those individuals in State Departments who may be charged with the responsibility of providing information for state leaders must begin to rearrange the way in which they view their jobs. It is no longer sufficient to consider this type of responsibility primarily that of data-gathering, although this is an important function. Information which is tabled and filed may be as useless as no information. We must begin to think of our job as one of gathering, processing, and presenting needed information in multiple ways and many times under tense situations. We must begin to think of information as a product--a product which is dynamic, which is changing, which is malleable, and which is perishable. We must

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realize that information flows as does water and electricity but that our connecting links are much more complex and vastly more tenuous than a water pipe or an electric line.

There are certain limitations which the information specialist must accept if he is to maintain a stable and acceptable attitude. The first of these limitations which the information supply personnel must accept is that he can be and should be only one input into the decision-maker. The information specialist cannot be and should not be the only source of information for the administrator. The wise decision-maker must seek the view of many publics. He must have input from many sources, and he must consider the views and the judgment of many individuals. Certainly, it is to be hoped that the information which is supplied by a practical and effective information unit will be one of the primary inputs to effective decision-making, but as the administrator considers the many alternatives he must rely upon his own good judgment and experience, the advice of long and trusted associates, as well as the information and data supplied in a more formal manner; and all of this must be viewed in the light of the economic, the political, and the social climate in which the administrator operates.

Probably the most important ingredient of an effective information dissemination system, whether it be organized data for decision-makers or repackaged syntheses of research materials for programmatic change, must be the individual involvement of the disseminator and the information user. I have come close to accepting the fact that it is almost always essential that information, to be effectively transmitted, must at some point involve person-to-person communication. This is not to say that knowledge cannot be passed, that generalized information cannot be spread; but if change is to occur, if decisions are to be influenced, someone, some human, must be the bearer of the information.

Most of what has preceded has been theorizing based on some experience. The most needed condition for successful information gathering, manipulation, and acceptance is the attitude of the individuals involved. The process of gathering, massaging, and providing information is greatly enhanced if all parties involved have come to accept the fact that information is essential, if they have identified the kinds of information needed, and if they have specified the form of the information desired. Until we begin to look at an information system in this light, the data-gathering, the computer programming, and the report publication have little chance of impacting upon programs in vocational and technical education. The goals of all of our work with information and data should be to assist with decisions, to improve the decision-making process, to bring about change in programs, and to assist in the understanding of how students learn, why training is necessary, and what types of training may be most appropriate.

How do we begin to gather and provide the types of information which may be required? The first thing necessary is to determine the present state of the art, the accumulation of a data base with which we can base some estimates of progress. We must begin to gather complete and accurate data which tell us about the teachers we have; about the students who are enrolled; about the equipment and facilities that are available; about the dollars that are being spent; about the manpower needs of the state and locality; about the other programs which may be supplying trained manpower; about the effectiveness of our training in terms of student placement, advancement, and career development; about those citizens in our state and localities who need special kinds of training programs to effectively move them into the social mainstream and employment mainstream. All of these kinds of data which tell us where we presently are must be the first step in the data-gathering process. This information must then be programmed in such a way that it is kept current, that it is readily available, and that it is combinable with other kinds of data as may be needed. It is futile to try to foresee all of the possible uses of information or requirements for information which may occur. We must make our system responsive and flexible enough that it can meet and meet quickly the information requirements of the leaders of our programs.

We have much to learn about how to provide information in the forms that are most usable to administrators. Many different types of packaging need to be tried. If we are to successfully meet the information needs of the coming few years, we must know more about how administrators use information and how it can be provided to them most effectively. We do know that if it is to catch the attention, it must be information that can be readily understood, that can be presented briefly, and that can offer alternative approaches to a specified problem. The administrator, on the other hand, must attempt to foresee as accurately as possible what information he is going to need and the way he would like to have it formulated. He must also ask for--in fact, insist upon--the service of information in the most readily usable form. He must be willing to provide the time, personnel, and resources necessary to meet the complicated challenge of knowledge accumulation and dissemination.

STUDENT ACCOUNTING

THE MINNESOTA VOCATIONAL FOLLOW-UP SYSTEM

DAVID J. PUCEL

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OVERVIEW OF THE TOTAL MANAGEMENT INFORMATION SYSTEM

The Vocational Follow-Up System is funded by the Minnesota State Department of Education, Division of Vocational and Technical Education, to gather information useful in decision-making concerning the improvement of the post-high school full-time day programs offered in the area vocational-technical institutes of Minnesota. It is administratively located within the Department of Vocational and Technical Education, University of Minnesota. The system developed as an outgrowth of Project MINI-SCORE, which had an extensive follow-up system. Data-gathering instruments and techniques have been developed and perfected with the assistance of representatives of the area vocational-technical institutes and the State Department of Education. The instruments provide student population information, program termination information, and student and employer follow-up information. This information is synthesized and reported to State Department personnel and to the directors of the vocational-technical institutes.

Historical Development

The Vocational Follow-Up System is a result of the concern of vocational educators in the State of Minnesota for an objective information base upon which to make decisions. Prior to the establishment of the system, information was being gathered concerning the students who participated in vocational programs as well as follow-up information from the students and their employers. However, it was not being gathered consistently across the state. Inconsistencies occurred in terms of both the types of information gathered by the various institutes and the nature of the way the data were collected. Attempts at aggregating the information in meaningful ways generally met with frustration. With increased pressures for accountability, it became more and more apparent that a uniform system of data gathering was needed.

Overview of the Vocational Follow-Up System

Organization

The Vocational Follow-Up System is a centralized follow-up system serving all of the Minnesota area vocational-technical institutes. It was created on the assumption that it is more efficient and productive to have a centralized staff devoted to the gathering, coding, and reporting of information than it is to have a decentralized system with specialized people in each institute. An examination of the relative costs of staff to conduct the functions of the Vocational Follow-Up System in each of over 30 institutes, as compared to the costs of a centralized system, has revealed that the aggregate costs of systems in all these institutes would far exceed the costs of a centralized system. In addition, the gathering of information from over 30 sources has a tendency to introduce error within the data gathered.

Another major advantage of a centralized system is the availability of staff to undertake the developmental efforts required to update questionnaires and data-gathering instruments and to refine the data-processing system. The data-gathering procedures used by the system were developed to minimize the burden on the individual institutes. Institute personnel do not have to go into their files in order to provide any of the information to the system. Enrollee information is gathered directly from the students; termination information is provided by the counselor when the student terminates; and all of the information retrieval necessary to follow up students is accomplished by the Vocational Follow-Up System.

The system is an outgrowth of Project MINI-SCORE which was conducted within the State of Minnesota by David J. Pucel and Howard F. Nelson of the Department of Industrial Education, University of Minnesota. Although the objectives of Project MINI-SCORE were to investigate and develop counseling aids for use with people who wished to attend the Minnesota area vocational-technial institutes, many of the procedures developed through the project appeared applicable to the information needs of the State of Minnesota.

In 1968, computer print-outs were generated of the biographical information gathered by Project MINI-SCORE on students from the area vocational-technical institutes and of the follow-up information which had been gathered. This information was presented to the Minnesota State Department of Education and to the directors of the institutes. After the information was examined by the various decision-makers, it was decided that the information was useful for decision-making purposes and that with future modifications based upon input from the institutes and the State Department of Education, the information should be gathered on a continuous basis. Consequently, early in 1970, the State Department of Education invited the University of Minnesota to prepare a proposal for such a system. A proposal was written and initiated by principal investigator David J. Pucel, Professor, Department of Vocational and Technical Education, University of Minnesota. The proposal was accepted, and the Vocational Follow-Up System began November 1, 1970. During its first year of existence it was operated as an expansion of Project MINI-SCORE, and the old Project MINI-SCORE instrumentation was used. Since that time new instrumentation has been developed with the aid of those who make decisions using the information.

Objectives

The major purpose of the Vocational Follow-Up System is to provide vocational educators in the State of Minnesota with information that will be valuable to them in making decisions concerning the improvement of vocational education programs. Within the present interpretation of this general purpose, the following specific activities are performed yearly:

1. Gather and report one-year follow-up information which can be used to describe the post-graduation activities of Minnesota post-high school area vocational-technical institute full-time day program graduates.

2. Gather and report biographical information which can be used to describe enrollees who enter the Minnesota post-high school area vocational-technical institute full-time day programs.

3. Gather and report information concerning how students who enroll in the Minnesota post-high school area vocational-technical institute full-time day programs terminate their enrollment.

4. Conduct related research which will facilitate the accomplishment of the previously stated activities.

General Description

The basic system model used to gather and report the information necessary to accomplish these objectives is presented in Figure 1. A table of input data is presented in Table 1. Upon enrollment, students provide biographical information and identification information necessary to describe them and follow them up in the future. For students terminating their enrollment, the institutes report the reasons for the terminations which are later summarized to provide information on student program completions and withdrawals. One year after graduation, students and their employers are followed up to determine how well they perform on the job. The three types of information are summarized yearly and reported to school and state representatives.

Relationship of the Vocational Follow-Up System to Decision-Makers

The Vocational Follow-Up System is designed to gather and present information to two basic groups of decision-makers: state department personnel and local school personnel. State department personnel use the information primarily for: (1) communicating with the federal government and the state legislature and (2) identifying programs that may require revision, expansion or reduction. The local school personnel use the information primarily to: (1) communicate with the state department, local community groups, and the legislature and (2) identify programs that require revision, expansion or reduction.

In order to ensure that the information gathered is relevant for these purposes, the Vocational Follow-Up System is in continual communication with:

a. The Minnesota Area Vocational-Technical Institute Directors' Association

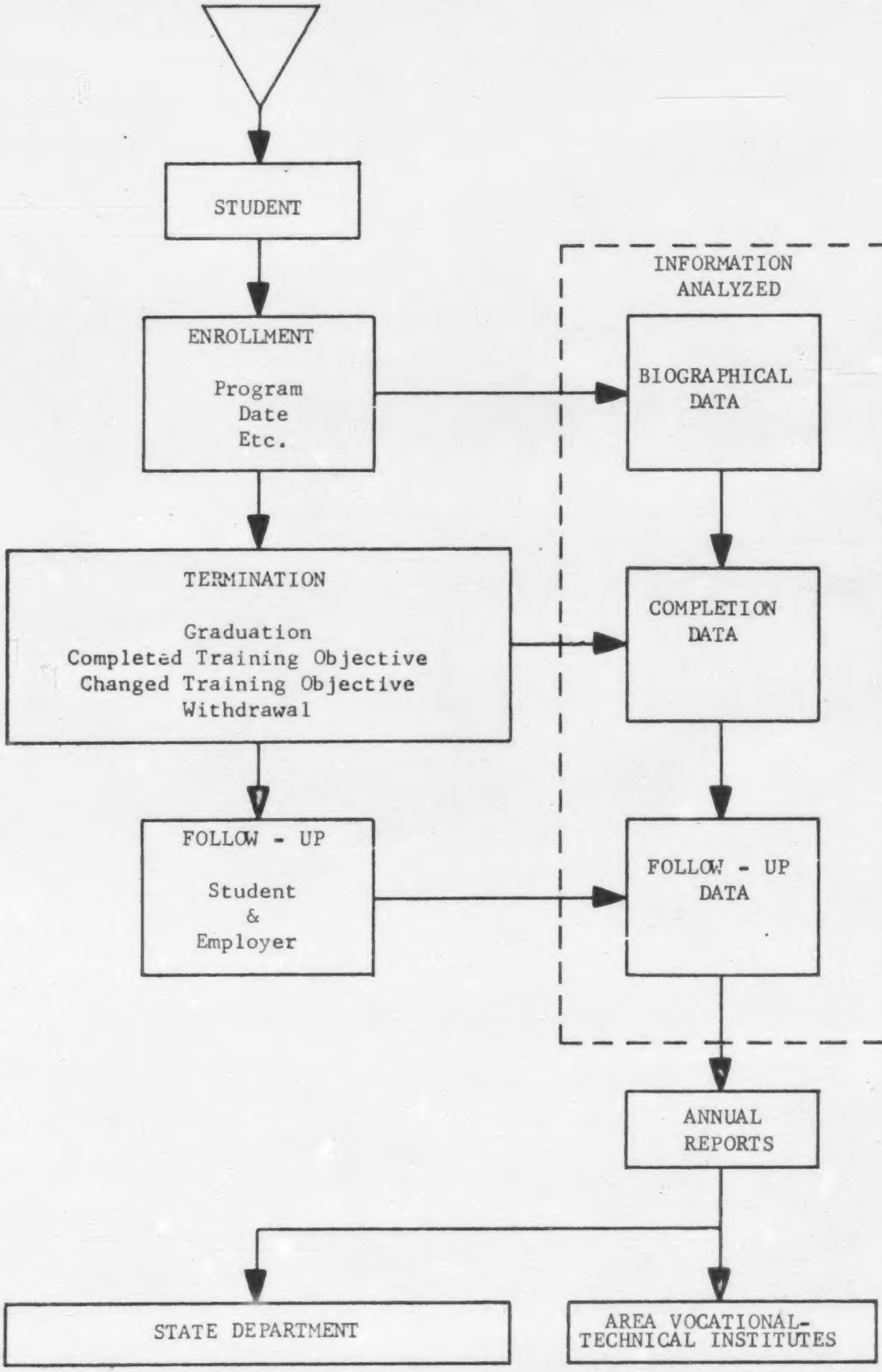

Figure 1. Vocational Follow - Up System

Table 1. Input Data

Input	Source of Data	Method of Collection	Method of Entry	Frequency of Collection	Output Report Number and Destination
Biographical Data (Enrollee Information Form)	Student	Form filled out at time student begins class	Punch Card	Continuous	Biographical Data Report
Termination Data (Termination Report Form)	School representative	Form filled out at time student terminates	Punch Card	Continuous	Termination Report
Follow-Up Data	Student and employer one year after graduation	Mailed forms	Punch Card	Continuous	Follow-Up Report

b. The Minnesota Area Vocational-Technical Institute Counselors' Association

c. The Minnesota Statewide Advisory Committee on Vocational Program Evaluation

d. The Minnesota State Department of Education, Vocational-Technical Division

e. The Vocational Follow-Up System Advisory Committee

The Vocational Follow-Up System Advisory Committee is appointed by the state director and contains representatives from each of the other groups mentioned plus a representative from the Minnesota State Department of Manpower Services, the private vocational schools, and industry.

Operational Description of the Vocational Follow-Up System

Input

The objective of any information-gathering system is to gather the minimum amount of information that is required to support decision-making. Therefore, the Vocational Follow-Up System data base was developed after a study of the minimum amount of information that would be required to allow vocational educators to make decisions concerning their programs. The primary function of the system was to gather follow-up information which could be used to evaluate the overall effectiveness of programs. This follow-up information would also be used to satisfy the federal requirements for follow-up students who participate in vocational programs utilizing federal funds. Since the follow-up was the primary focus of the system, it was decided that additional information which could be used to facilitate decision-making would also be gathered to the extent that it did not overshadow the original purpose or cause an unrealistic increase in the cost of operating the system. Therefore, all information eventually included in the system was limited by the data-gathering techniques necessary for conducting the follow-up. In some cases this meant that less than ideal methods of gathering the other types of information were developed so they were compatible with the follow-up, even though it was recognized that more refined systems for gathering the information were possible if additional funds had been available.

The information requirements of the Follow-Up System included four instruments: (1) an instrument to gather the student addresses and other biographical information upon student enrollment in area vocational-technical institutes (Enrollee Information Form), (2) an instrument to gather information concerning how students terminated their enrollment (Termination Report Form), (3) a follow-up questionnaire to be sent to graduates one year after graduation (Follow-Up Questionnaire), and (4) an instrument to gather information from the employers of graduates (Employer Questionnaire).

Enrollee Information Form. The purpose of the Enrollee Information Form was to gather biographical information from students as well as their addresses which could be used during follow-up. A series of meetings were held with representatives of the area vocational-technical institutes to determine which types of information they felt might be useful in describing the populations enrolling in the institutes. It was decided that the information needed could be classified into five categories: (1) identification information--information useful in identifying and locating the student; (2) enrollment information--information which describes where and when students enter the program in which they enroll; (3) categorical information--information which allows for the classification of students into categories of reporting interest; (4) history information--information which allows for a description of selected aspects of a student's past activities; and (5) test information --information which allows for a description of students in terms of standardized test scores. The specific information identified under each of these major categories is listed below.

I. Identification information

1. Social Security number
2. Name
3. Permanent address
4. Telephone number
5. Parent or guardian name
6. Parent or guardian address
7. Parent or guardian telephone number
8. Parent or guardian occupation

II. Enrollment information

9. Program in which enrolled
10. Program starting date
11. Vocational school in which enrolled

III. Categorical information

12. Age in years
13. Sex
14. Marital status
15. Annual income of household
16. Number of people living in household
17. Handicaps

IV. History information

18. Major activity during previous year
19. Last high school attended
20. Whether a person graduated from high school and the date of last attending high school
21. Number of years of education completed

22. Whether or not the person participated in prior high school vocational training
23. Whether or not the person participated in prior post-high school vocational training
24. Amount of prior work experience
25. Whether the student previously attended an area vocational-technical institute

V. Test information

26. The schools were given the option of whether or not they wanted to provide test scores on the students enrolling in their programs. If they provided these scores, the scores would be summarized and reported. However, providing the scores meant that the schools would have to go back into their files to retrieve that type of information.

The result of many discussions concerning the information that should be gathered and how it should be gathered was the Enrollee Information Form presented in Appendix A. The form was developed in such a way that most of the information provided by the new enrollee could be punched directly without any input from the Vocational Follow-Up System staff. Pieces of information that had to be converted by Vocational Follow-Up System staff into numerical data that are suitable for data processing are indicated by red boxes. It was felt that it was more efficient to have students provide narrative responses to these items and to have the office staff code them than it was to try to explain the entire coding system to the students and have them select an alternative. Most students would not have sufficient background to select the appropriate alternative. In those cases where it was felt that the students could select the appropriate alternative, students were presented choices to be made and the data did not have to be converted.

The information collected through this form was summarized and reported to the schools. Procedures for summarizing and reporting the information are discussed in later sections of this report.

Termination Report Form. The second form which had to be developed was a termination report form. This form was needed by the institutes to report how students who enroll in a program terminate their enrollment. The form was developed with the consultation of personnel from the area vocational-technical institutes as well as the Minnesota State Department of Education. After a series of meetings, it was decided that terminations could be classified into four categories: withdrawal, change of program, completion of training objective, and graduation.

First, a student could withdraw from a program for a number of different reasons. The reasons might be: (1) unsatisfactory program performance, (2) economic reasons, (3) entrance into the armed forces, (4) personal problems, (5) transfer to another AVTI, (6) transfer to a junior college, (7) transfer to a college or university, (8) transfer to institutions other than those mentioned above, or (9) reasons unknown. Second, a student could transfer to another program in the same institute. Third, a student could complete his training objective even though he did not graduate. "Completion of a training objective" was defined as a situation where a person left the program before graduation for employment in a directly related occupation, or a student stayed in the program until completion but did not perform satisfactorily enough to meet all the qualifications for graduation. Some of the schools issued trade certificates to those individuals who completed the entire program but did not do so satisfactorily. Fourth, a student could successfully graduate from the program.

The Termination Report Form, presented as Appendix B, was developed to gather the termination information. It was developed in such a way that it could be sent directly to keypunchers for data processing after the Vocational Follow-Up System staff completed the information required in the red boxes, which represented the conversion of verbal information to numerical values ready for data processing. The Termination Report Form is completed by an institute representative and not the student.

Follow-Up Questionnaire. The third instrument developed by the Vocational Follow-Up System was the Follow-Up Questionnaire. The Follow-Up Questionnaire (Appendix C) was designed to gather information capable of answering the questions: "Was the training program effective in assisting graduates to obtain related employment and maintain related employment during the first year after graduation?" "Was the training program relevant to the requirements of the jobs graduates entered during their first year after graduation?" "What job-related experiences or history did graduates have during their first year after graduation?" In order to obtain information concerning these basic questions, the questionnaire was designed in three sections: status one year after graduation, history during the year after graduation, and training program assessment by students in light of their job experiences during their first year after graduation (Figure 2).

The primary piece of information gathered concerning the status of graduates one year after graduation was their employment status. Employment status was broken down into five categories: employed in a closely related occupation, employed in a broadly related occupation, employed unrelated, unemployed, and unavailable for employment. This categorization allows decision-makers to assess the number of graduates employed in the exact occupations for which trained (employed closely related), the number employed in related occupations but not the exact occupations for which trained (employed broadly related), the number employed in unrelated occupations (employed unrelated), the number actively seeking employment who cannot find it (unemployed), and the number unavailable for employment. The unavailable for employment category was separated from the unemployed category because there are reasons, such as illness, which society recognizes as legitimate for a person not being employed.

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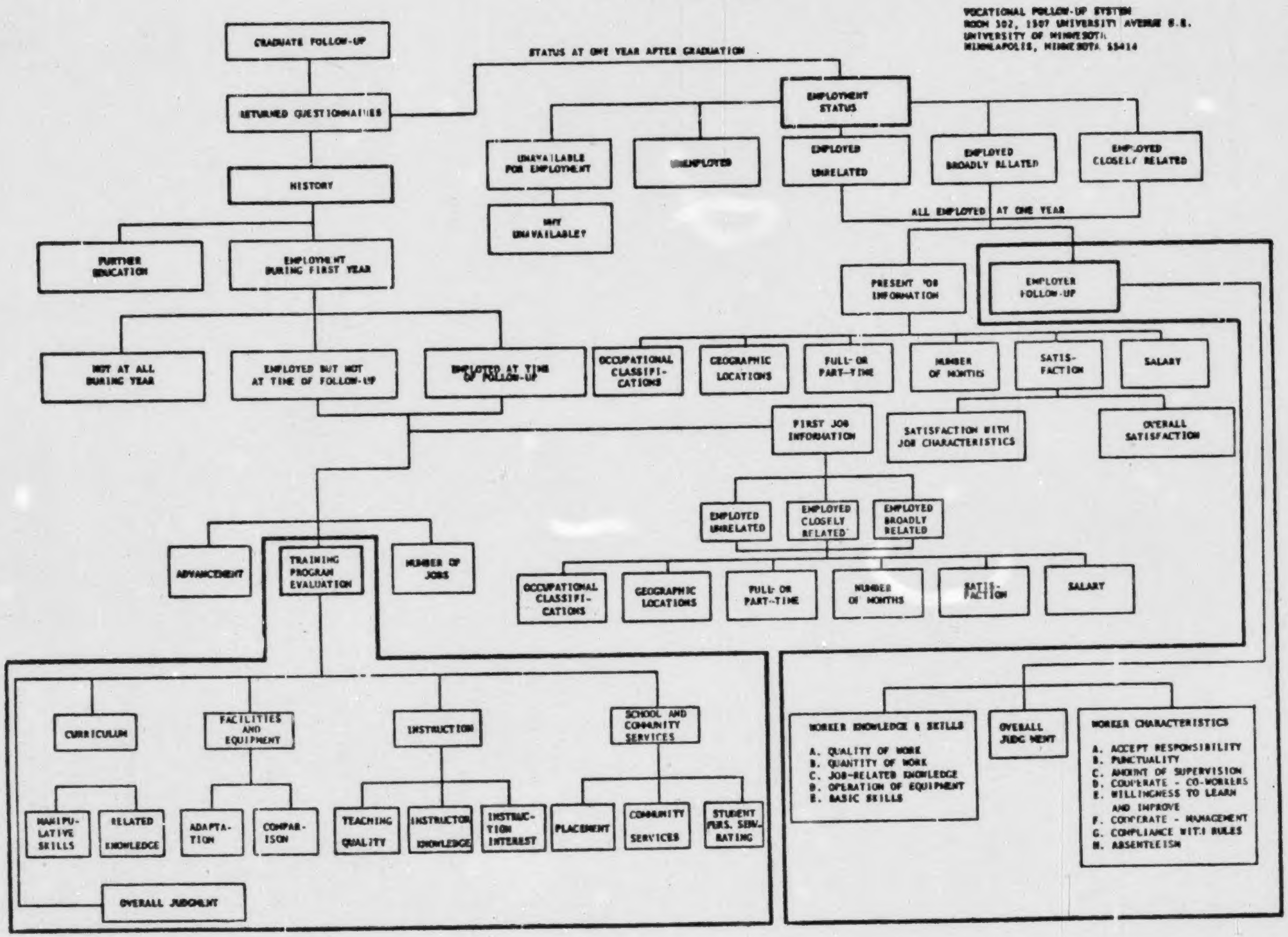

Figure 2. Organization of the Follow-Up Information Obtained from Graduates of Minnesota Voctional Institutes and Their Employers

If a person is employed one year after graduation, decision-makers are interested in what the job is, where the job is located, whether it is full-time or part-time, how long the person has been employed, how satisfied the person is with the job, and how satisfied he is with the salary he is making. Therefore, the questionnaire includes items to provide information regarding each of these questions. This information allows decision-makers to examine the types of occupations graduates of a particular program are entering, where graduates of a particular school distribute themselves, whether or not the graduates are obtaining full-time employment, how satisfied the graduates are with their jobs, and how much money the graduates of a particular program are making.

The history information provides decision-makers with knowledge of the student's job history and education-related history during the first year after graduation. This history includes information on further education, whether the person was employed at all during the first year after graduation, whether the person experienced advancement during the first year, how many jobs the person had during the first year, and a description of the person's first job. The first job description contains information similar to the descriptive information gathered on the job that the person had one year after graduation, as indicated above. If the person had only one job after graduation and held it for a year, the first job information and the information concerning the job one year after graduation would be the same. If the person had more than one job during the year and was employed one year after graduation, this comparable information on different jobs allows for a comparison of what happens to graduates at the time they graduate and their employment status one year after graduation.

Follow-Up Questionnaire, Training Program, and Job Satisfaction Evaluation, and Employer Questionnaire. The training program and job satisfaction evaluation portions of the Follow-Up Questionnaire were developed in conjunction with the Employer Questionnaire after an intensive staff study entitled "The Development of the Vocational Follow-Up System Student and Employer Follow-Up Questionnaire" (Pucel, Mohamed, and Asche, 1972). Therefore, these portions of the Follow-Up Questionnaire will be discussed with the Employer Questionnaire. They were developed to gather information that would indicate the student's reaction to the training program, the student's job satisfaction, and the employer's reaction to the student. Diagnostic information would thus be available in the event that the overall effectiveness of a vocational program was found to be low. The information can also be useful in describing the student and employer reactions to the skills which students developed in particular components of the program. The rationale surrounding the development of these assessment instruments suggests that (1) the assessment of a graduate's ability to perform on the job requires the assessment of the graduate's performance by himself and by his employer, and (2) a person's ability to perform on the job is related to his skills and knowledge as well as to his personal characteristics. Therefore, the training program and job satisfaction evaluations were designed to have the employee, or graduate, evaluate the training program in terms of the skills and knowledge he gained through the program in light of those required on the job and his satisfaction with his job. The Employer Questionnaire was designed to allow the employer to evaluate the graduate's performance in terms of (1) the graduate's skills and knowledge related to performance on the job and (2) the ability of the graduate to satisfy the personal requirements of the job (Figure 2).

In the context of the Vocational Follow-Up System, the evaluation of the training program by past graduates was necessarily gross. This was due to the objective of the system to develop procedures and instruments that could be used with graduates of all of the vocational-technical programs. This restriction made it impossible to identify specific competencies required of people in a particular occupation and to have the graduates rate the usefulness of these competencies on the job. The procedure used to develop the training program questionniare was first to identify the major components of a training program that could affect a graduate's performance on the job, and then to develop questions which would assess these basic components such that the questions could be used with graduates of all vocational programs. An investigation into the basic facets of a training program which would directly affect the ability of graduates to perform on the job revealed three components of the training program and a component related to the environment within which the training program was conducted. The three basic components of the training program were: (1) curriculum, (2) facilities and equipment, and (3) instruction. The general component within which a program is operated was further broken down into school and community services.

A further look at training program curricula revealed two major components, the manipulative skills or performances required on the job and the knowledge required on the job. Therefore, curriculum was evaluated in terms of the extent to which the curriculum prepared graduates in the manipulative skills and knowledge required on the job.

It was assumed that training programs should utilize equipment and facilities which would cause the least problem for students as they adapt to post-training employment. Therefore, facilities and equipment were evaluated on (1) the extent to which the facilities and equipment used in training were similar to those used on the job, and (2) the problems experienced by graduates in adapting to equipment used on the job.

An investigation into variables which might affect the instruction received by students revealed three basic variables: (1) the teaching ability of the instructor, (2) instructor knowledge, and (3) the ability of the instructor to relate to students. If an instructor knows the content but cannot communicate it, he is not effective. If an instructor can communicate content but is not knowledgeable, he is not effective. Some people also feel that if an instructor cannot relate to the students and be sensitive to their needs, he cannot be effective. Therefore, students were asked to rate the teaching quality of the instructors, the knowledge of the instructors, and the interest shown by the instructors in their progress.

In addition to asking graduates to evaluate each of the three basic components of the training program (curriculum, facilities and equipment, and instruction), graduates were asked to make an overall judgment concerning the training program from which they graduated. They were asked if they would choose the same training program if they could start all over again.

Although the primary interest of vocational decision-makers concerning the student's evaluation of the school is in terms of the instructional program, the program can be evaluated only in light of the graduate's perception of the environment within which the program exists. Besides providing instruction, the school provides an instructional environment including ancillary services required by students as they enter the school, proceed through the program, and exit the school. Therefore, an investigation was made into the major ancillary services available to students that might affect their progress through their instructional program. This investigation revealed that the ancillary services could be grouped under two major headings: school services and community services. The school services identified were related to job placement, counseling with personal problems, help in making career decisions, help in securing part-time employment, help in obtaining financial assistance, help in securing housing, youth organizations, recreational programs, study-library and other learning resource facilities, and health services. The community services were broken down into three major groupings: housing, job opportunities, and recreational facilities. The specific items used to gather information from graduates concerning the training program and the training program environment are found in the following sections of the Follow-Up Questionnaire (Appendix C): VII-Curriculum, VIII-Facilities and Equipment, IX-Instruction, X-(Overall Judgment), and XI-School and Community Services.

Besides asking graduates questions concerning the extent to which their skills and knowledge were sufficient to perform adequately on the job, the graduates were asked about their satisfaction with their job. In Figure 2 graduate satisfaction is located in the "employment status" section because it describes the status of an individual, but that section of the questionniare was planned with and designed to be interpreted with the training program evaluation information.

The decision to include items related to job satisfaction in the follow-up questionniare was made after lengthy discussions of the appropriateness of using such information to judge vocational programs. Some argued that this information would not be of value in trying to judge the effectiveness of vocational programs because the post-high school area vocational-technical institutes have little influence upon these factors. Others argued that it would be useful to the institutes to determine how satisfied their graduates were with their jobs because if their graduates were consistently dissatisfied with certain aspects of their employment, this might reflect an area where the institute might place emphasis in its instructional program to help students avoid the dissatisfaction. After examining the various facets of job satisfaction which might have relevance to vocational program modification, two basic types of information were identified as being useful. The first was an overall assessment of the graduate's satisfaction, and the second was an assessment of selected components of job satisfaction. The 12 selected components were salary, fringe benefits, potential for advancement, supervision and management, co-workers, company policies and practices, pace of work, facilities and equipment with which to do the job, working conditions, variety of work tasks, job security, and safety conditions. The specific items used to gather information from graduates concerning their job satisfaction can be found in Section VI, Job Satisfaction, of the Follow-Up Questionnaire (Appendix C).

The Employer Questionnaire was designed to obtain information from employers concerning the performance of graduates one year after graduation. The Employer Questionnaire is composed of two major sections (Appendix D). The first section presents information which identifies the graduate and the employer, and the second section is the "Employee Performance Survey." It was designed to gather information concerning the graduate's skills and knowledge related to performance on the job and the ability of the graduate to satisfy the personal requirements of the job.

The "Employee Performance Survey" section of the Employer Questionnaire was developed around the same basic characteristics of a training program and personal qualities of graduates that could affect a graduate's performance on the job referred to in the previous discussion of the evaluation of the training program by graduates.

In examining the types of evaluations that should be sought from employers concerning the knowledge and skills possessed by the graduates, three major components were identified. The first was the extent to which the graduate possessed specific job-related knowledge important to success on the job; the second was the degree to which the graduate was able to operate the equipment and apparatus used on the job; and the third was the degree to which the graduate possessed basic reading, verbal, and computational skills required on the job. Assuming that employers are interested in production, it is also important to determine how well the graduates can apply their skills and knowledge. After considering how to assess a graduate's production, it was decided that such production has two characteristics--quality and amount. Therefore, employers were asked to evaluate the quality and quantity of a graduate's work.

In addition to an assessment of graduates' job-related skills and knowledge, it was felt that it would be valuable to obtain an assessment of the extent to which graduates possessed personal qualities consistent with others in the occupation. A person might possess all of the required skills and knowledge but might not be able to adjust to the social environment. Therefore, various job-related personal characteristics that might affect performance on the job were identified. They were condensed into eight aspects which representatives of the institutes and the State Department felt would be appropriate to have employers evaluate. These eight selected aspects were: willingness to accept responsibility; punctuality; ability to work without supervision; willingness to learn and improve; cooperation with co-workers; cooperation with management; compliance with company policies, rules, and practices; and work attendance. Hopefully, employer ratings of these selected aspects provide information that can be useful in helping students to better understand the social environment which they will enter upon employment.

In addition to assessing specific elements of a graduate's job performance, an overall assessment of performance was developed which asked the employer to make an overall judgment of the graduate's performance. The specific items used to gather information from employers concerning graduates can be found in Appendix D.

The follow-up procedures utilized by the Vocational Follow-Up System in conducting the one-year follow-up were originally developed through Project MINI-SCORE after a formal study of follow-up procedures which has been published in the article entitled, "Questionnaire Follow-Up Returns as a Function of Incentives and Responder Characteristics" (Pucel, Nelson, and Wheeler, 1971).

The follow-up procedure begins with the studnet follow-up one year after a student graduates from one of the full-time day programs of the Minnesota area vocational-technical institutes. Follow-ups are conducted every month since people graduate from the institutes every month. The following is a description of the follow-up procedure presented in Figure 3.

One year after a person graduates from one of the institutes, he is sent a pre-letter which prepares him to receive the questionniare and indicates its importance. This letter presents a psychological appeal. He is told that if he fills out the questionnaire, he will assist other people like himself by providing the institutes with information with which to improve their programs for future students.

One week after the pre-letter is mailed, the first follow-up questionnaire is sent. The first follow-up package includes a return-addressed stamped envelope, a follow-up questionnaire printed on green paper, a personalized cover letter, and a packet of instant coffee. The questionnaire is overprinted lightly in red with the word "confidential" (Appendix C). The personalized letter again makes a psychological appeal to the graduate to complete the questionnaire. It also refers to the packet of instant coffee which is included in the package. The research study conducted by Project MINI-SCORE concerning methods of follow-up indicated that follow-up returns could be improved by approximately 20% if a pre-letter were used, the questionnaire was printed on green paper, and a novelty such as a packet of instant coffee was included with the materials. Materials included in the follow-up package are personalized; the addresses on the envelope and the letter are all typed, and the letter is hand-signed. This personalized approach is thought to be one of the reasons for the success of the Vocational Follow-Up System procedures.

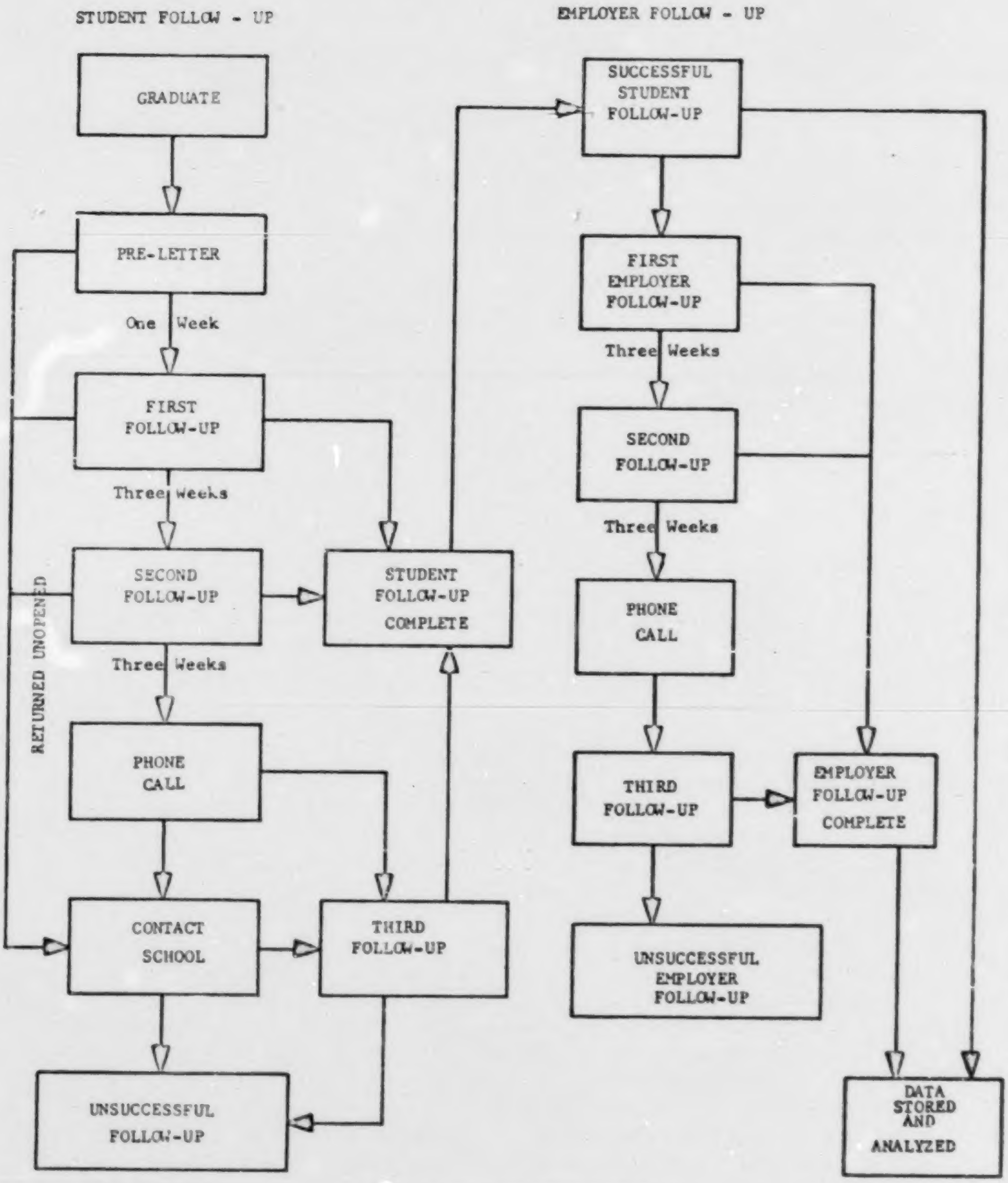

Figure 3. Vocational Follow-Up System: One-Year Follow-Up

The first follow-up usually results in one of three things. A graduate completes and returns the questionnaire, the package is returned unopened, or the questionnaire is not returned. If the student follow-up questionnaire is completed and returned, it is ready to be processed further. If the package is returned unopened, the institute from which the student graduated is contacted to determine if the institute has a different address for the student. It the institute has a new student address, that information is used to re-contact the student. If the student does not have a change of address registered with the school, the student is classified as "no return" and is no longer followed up.

If the student does not respond to the first follow-up and the materials are not sent back unopened, a second follow-up is conducted three weeks after the first follow-up. The second follow-up includes a stamped return-addressed envelope, another copy of the questionnaire, and a personalized second letter appealing to the graduate to complete the follow-up. If the second follow-up is not returned within three weeks, attempts are made to reach the graduate by phone, and a personalized appeal is made for the graduate to fill out the form. A third follow-up package is sent to those who are reached by phone and who agree to complete the questionnaire. The third follow-up package is identical to the second. Students are terminated from the follow-up if they do not respond to the third follow-up within three weeks, or if they indicate, upon receiving the phone call, that they do not wish to complete the questionnaire.

If the student completes the questionnaire and he was not employed at the time of follow-up, his information goes directly to data processing for processing and analyzing. If he was employed, he was asked to provide the name and address of his immediate supervisor on the job. The questionnaire informed the student that this person would be contacted. The information which the student provides is then used to contact his immediate supervisor on the job.

The employer questionnaire sent to employers is printed on white paper and is overprinted lightly in red with the word "confidential" (Appendix D). The employer questionnaire package includes the questionnaire, a personalized letter explaining the role that employers can play in improving the quality of vocational education programs, and a stamped return-addressed envelope. If the employer does not complete the first questionnaire within three weeks, he is sent a second employer follow-up package which is identical to the first. If the employer does not complete the second follow-up questionnaire within three weeks, he is contacted by phone; if he agrees to fill out the questionnaire, he is sent a third employer follow-up package. If the employer does complete the follow-up as a result of any of the three attempts, his response is combined with the information from the graduate follow-up and sent to data processing for punching, storage, and analyzing. Employers who do not return their questionnaires are placed in an "employer no return" category.

The above procedure has been used over a period of approximately five years and has consistently yielded yearly return rates of about 85% for the student follow-up and about 96% for the employer follow-up. These return rates are attributed to the personalized approach used during the follow-up, the appeal made to both students and employers for ther assistance in improving vocational education programs, and the novelties and techniques which have been proven through research.

The follow-up procedures required to complete the student and employer follow-ups for one month's group can take as long as 19 weeks if the maximum length of time is taken at all steps.

Output

The formats for the system instruments were developed after an investigation of alternative data processing procedures. Consultation with data processing personnel revealed two general procedures: (1) gathering the data using a standard questionnaire format and having the data keypunched and (2) gathering the data with an optical scan questionnaire format and having the data optically scanned. After intensive study of the relative merits of developing the forms according to each format, it was decided to adopt the standard questionnaire format. The five primary considerations that led to this decision were: (1) the desire to process all of the information using similar methods, which would increase staff flexibility and reduce training time for new people; (2) the large amount of descriptive information requested such as name, address, parent occupation, parent address, etc., which would require large alphabetical grids if an optical scan format were used; (3) the cost of printing a larger number of pages (necessitated by optical scanning) and of mailing this information; (4) the possibility of lower return rates using the optical scanning form, which would have large, distracting grids potentially more difficult for students to complete; and (5) the need for a complex coding system to convert some of the gathered information to numerical values that could be processed with the computer. An example of the conversion problem can be seen in the gathering of information on parent's or guardian's occupation. It was hypothesized that if one wanted reliable information concerning the classification of the parent's or guardian's occupation, one should ask the student to write down the name of the exact occupation and then have people familiar with the coding system code the occupation. Most students know what their fathers or guardians do but would have difficulty determining if the occupations should be coded as "service workers," "craftsmen," etc. The same coding problem existed with the coding of student identification numbers and job classification codes.

Each type of information received by the Follow-Up System is processed separately when it is received. Later it is all combined into a composite student record. When the information is received, those items which require conversion to numberical values are coded and the forms sent out for keypunching. The information is returned to the office in the form of IBM cards.

Special computer programs are used to edit each type of information to assure that the keypunching is accurate and to eliminate any impossible combinations of responses by students. For example, if a person indicates that he is not employed one year after graduation, he could not also have an employer one year after graduation. The edit of the follow-up information would find and list such an instance. The form for that particular student would then be reviewed in detail to solve the illogical data pattern. Rules have been developed for solving such inconsistencies, if possible. After the information from a particular form is edited, it is placed on computer tape. The entire above process is performed for each type of information: enrollee information, termination information, and follow-up information. The information is stored independently because each piece of information on a particular student is gathered at a different point in time. The enrollee information is gathered upon entry into the school; the termination information is gathered upon exit from the school; and the follow-up information is gathered one year after graduation. Therefore, it is not possible to merge all of this information until the follow-up information is gathered and processed.

The information gathered at different points in time is combined using special computer programs. A tape of information gathered with the enrollee information forms is united with a tape of information gathered on the same individuals upon exit from the programs using the termination reports. This combined information provides a vehicle for identifying those individuals who should be followed up. The termination information provides the dates of graduation, and the enrollee information provides the addresses of the students. After a person is followed up and his follow-up information has been processed, it is combined with the other information to provide the combined student record. This record can then be used to investigate the relationships among variables and to conduct future follow-ups if they are desired.

The data are reported to vocational educators in the State of Minnesota to facilitate decision-making relative to improving the vocational education programs. Separate reports are generated for each of the three types of information (enrollee information, termination information, and follow-up information). (See Table 2.) Attempts are being made to provide these reports to decision-makers in the state by November 1 of each year.

The reports are presented at four different levels of aggregation. The first level, which is the most inclusive level of aggregation, summarizes information over all full-time day progamms offered by the Minnesota area vocational-technical institues. This report allows one to examine information summarized from all of these programs in the State of Minnesota. The second series of reports presents information by curriculum or program area summarized over all programs of a given type in the state. For example, practical nursing information summarized over all practical nursing programs in the state is presented in one report. This allows people to examine information pertaining to a given program area as it exists across the State of Minnesota. The third series of reports summarizes information for each area vocational-technical institute

Table 2. Output Data

Output	Frequency of Report	Organizations and Officers Who Receive Reports on a Regular Basis	Organizations and Officers Requesting Reports
Biographical Data	Yearly (Nov. 1)	Director of Vocational Program Planning and Development	State Advisory Council
Termination Data		Local School Directors	Interested Public
Follow-Up Data			

in the state. This level of reports allows people to examine information summarized from all programs offered by a particular institute. The fourth, and most specific, series of reports summarizes information for each curriculum or program area in each institute. This allows people to examine information concerning a particular program in a particular school.

All of the reports present basic descriptive information. Sample tables from a follow-up report are presented in Figure 4. Each of the three major types of reports is prepared in the same way. The covers and the basic explanatory text are common to all four levels of a particular type of report. The text explains how to interpret the tables of information and provides a description of the context of the information. The tables included in all reports of a specific type have the same basic format and differ only in terms of the specific data included in the tables. For example, the follow-up report summarized across all programs in the state would contain the same tables as the follow-up report for a particular program in a given school, but numbers and percentages would vary. The state report would include information summarized over all graduates followed up who had been involved in programs in the state, and the report pertaining to a program in a school would summarize information only on graduates followed up who had been involved in that particular program. The reports are differentiated by a label on the front cover which identifies each specific report.

The data tables included in a report are created by processing the tape of the appropriate information with a special computer program that sorts out the information to be included in the report and generates the appropriate tables. The tables, in the form of computer print-outs, are then cut to 8 1/2" x 11" size. The text, which has been offset printed, and the tables are then combined, and the appropriate label for the report is placed on the front cover. The reports are then sent for binding. When they are returned from binding they can be mailed directly to the various decision-makers in the state.

The State Department receives copies of all reports, and each institute receives copies of reports of information gathered on students from that institute. Institutes also receive a copy of the overall state summary.

Currently, non-standard reports cannot be produced unless data from previous years are used. The data for a particular year become available for analysis just prior to the generation of the reports for that year.

Resource Requirements

Personnel are used for the various tasks required to gather and report the data on a need basis. All or none of the staff may be working on a particular task at any one time. Therefore, the personnel budget has not been broken down and allocated by task. Personnel costs, including fringe benefits, amount to about $73,000.

TABLE 6. EMPLOYMENT STATUS ONE YEAR AFTER GRADUATION--
GRADUATES EMPLOYED, UNEMPLOYED, OR UNAVAILABLE
FOR EMPLOYMENT ONE YEAR AFTER GRADUATION

	CATEGORY	NUMBER	PERCENT
1.	EMPLOYED CLOSELY RELATED	3452	52.19
2.	EMPLOYED BROADLY RELATED	491	7.42
3.	EMPLOYED UNRELATED	1255	18.97
4.	UNEMPLOYED	515	7.79
5.	UNAVAILABLE FOR EMPLOYMENT	901	13.62
	TOTALS	6614	99.99

TABLE 7. PRESENT JOB FULL- OR PART-TIME--OR PART-TIME
STATUS OF GRADUATES' JOBS ONE YEAR AFTER GRADUATION

	CATEGORY	NUMBER	PERCENT
1.	FULL-TIME EMPLOYMENT	4701	92.54
2.	PART-TIME EMPLOYMENT	379	7.46
	TOTALS	5080	100.00

TABLE 14. UNAVAILABILITY--REASONS GRADUATES WERE UNAVAILABLE
FOR EMPLOYMENT ONE YEAR AFTER GRADUATION

	CATEGORY	NUMBER	PERCENT
1.	MILITARY	475	52.72
2.	FURTHER TRAINING	66	7.33
3.	ILLNESS	42	4.66
4.	HOUSEWIFE OR PREGNANCY	289	32.08
5.	OTHER	29	3.22
	TOTALS	901	100.01

Figure 4. Follow-Up Report Sample Tables

Data processing requires a very fast computer to handle the large amounts of information efficiently. The data are analyzed using a CDC 6600 computer. Data are stored on magnetic tape after the cards have been edited. Data processing, other than personnel, costs about $16,000. Other operating costs, including overhead, are about $28,000. It is important to point out that these costs include all costs of operating the system and therefore, cannot be accurately compared with the costs of operating other systems in which the local schools and other ancillary state department services absorb large portions of the operating costs. Some states are only including costs to the vocational education planning unit in their operating estimates without calculating all of the other costs borne by other agencies.

APPENDIX A

ENROLLEE INFORMATION FORM

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Form 7173

*(1) (3) ☐0☐1☐☐ - *☐☐☐☐ (8)

Vocational Follow-Up System
Room 302, 1507 University Ave. S.E.
University of Minnesota
Mpls., MN 55414

ENROLLEE INFORMATION FORM

1. Social Security Number (9) ☐☐☐ - ☐☐ - ☐☐☐☐ (17)

2. Name (18) ☐☐☐☐☐☐☐☐☐☐☐☐ (29) Last (30) ☐☐☐☐☐☐☐☐☐☐ (39) First (40) ☐ Initial (41) ☐☐☐☐☐☐☐☐☐☐ (50) Maiden (if any)

3. Permanent Address (51) ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ (72) Street or Rural Route *(1) (2) ☐0☐2

(9) ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ (26) City (27)(28) ☐☐ State (29) ☐☐☐☐☐ (33) Zip Code *(34) ☐☐☐☐☐ (38)

4. Telephone Number (39) ☐☐☐ Area Code - ☐☐☐ - ☐☐☐☐ (48)

5. Parent or Guardian's Name (Not Spouse) (49) ☐☐☐☐☐☐☐☐☐☐☐☐ (60) Last (61) ☐☐☐☐☐☐☐☐☐☐ (70) First *(1) (2) ☐0☐3

6. Parent or Guardian's Address (Not Spouse) (9) ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ (30) Street or Rural Route

(31) ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ (48) City (49)(50) ☐☐ State (51) ☐☐☐☐☐ (55) Zip Code

7. Parent or Guardian's Telephone Number (Not Spouse) (56) ☐☐☐ Area Code - ☐☐☐ - ☐☐☐☐ (65)

8. Parent or Guardian's Occupation (Not Employer) (Not Spouse) ________________ *(66)(67) ☐☐

9. Program Enrolled In ________________ *(68) ☐☐☐ (70)

10. Starting Date Example: 0973 (71)(72) ☐☐ Month (73)(74) ☐☐ Year

11. Vocational School Enrolled In

12. Age in Years (75)(76) ☐☐ Years

13. Sex (77) ☐1 Male (77) ☐2 Female *(1) (2) ☐0☐4

(9-10)	Code	Name
☐	29	916 Vo-Tech Institute
☐	25	Albert Lea
☐	01	Alexandria
☐	17	Anoka
☐	02	Austin
☐	26	Bemidji
☐	23	Brainerd
☐	03	Canby
☐	27	Dakota County
☐	24	Detroit Lakes
☐	04	Duluth
☐	34	East Grand Forks
☐	05	Eveleth
☐	06	Faribault
☐	08	Granite Falls
☐	09	Hibbing
☐	28	Hutchinson
☐	10	Jackson
☐	11	Mankato
☐	12	Minneapolis
☐	13	Moorhead
☐	14	Pine City
☐	15	Pipestone
☐	33	Red Wing
☐	30	Rochester
☐	16	St. Cloud
☐	31	St. Paul
☐	18	Staples
☐	35	Suburban Hennepin, North
☐	32	Suburban Hennepin, South
☐	19	Thief River Falls
☐	20	Wadena
☐	21	Willmar
☐	22	Winona

14. Marital Status (check one)

(11) ☐1 Single (11) ☐2 Married (11) ☐3 Other

15. What was the approximate annual income of the household in which you lived last year? (check one)

(12) ☐1 Under $3000 (12) ☐3 $5000-$8000
(12) ☐2 $3000-$4999 (12) ☐4 More than $8000

16. How many people lived in the household referred to in Question 15 above? (13)(14) ☐☐

17. Are you (check those that apply)

(15) ☐1 Deaf

(16) ☐1 Hard of hearing (need hearing aid)

(17) ☐1 Speech impaired (stutter, etc.)

(18) ☐1 Blind (20/200 or less in better eye after correction)

(19) ☐1 Partially sighted (20/200-20/70 in better eye after correction)

(20) ☐1 Physically impaired (crippled, heart condition, etc.)

*Asterisks indicate red boxes.

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18. How did you spend most of last year? (check one)

(21) 1 Employed
(21) 3 Military
(21) 5 Other
2 Going to School
4 Unemployed (looking for work)

19. Name and address of last high school attended.

____

____

* (22) ☐☐☐ (24)

20. Do you have a high school diploma or its equivalent?

(25) 1 Yes If yes, date graduated (26)(27) ☐☐ Month (28)(29) ☐☐ Year
(25) 2 No If no, last date attended (30)(31) ☐☐ Month (32)(33) ☐☐ Year

21. How many years of school have you *completed?*

(34) 1 Less than 8
(34) 3 10
(34) 5 12
(34) 7 14
2 9
4 11
6 13
8 More than 14

22. Have you had prior *high school level* vocational training?

(35) 1 Yes (If yes, check below)

(36) 1 Related to program now enrolled in.
(37) 1 Unrelated to program now enrolled in.

(35) 2 No

23. Have you had prior *post-high school level* vocational training?

(38) 1 Yes (If yes, check below)

(39) 1 Related to program now enrolled in.
(40) 1 Unrelated to program now enrolled in.

(38) 2 No

24. Have you had prior work experience? (Indicate the number of *MONTHS* in each category; *FULL-TIME* means 35 or more hours per week.)

(41) ☐☐☐ (43) Months — Part-time work experience unrelated to program now enrolled in. Example: 026 (months)
(44) ☐☐☐ (46) Months — Full-time work experience unrelated to program now enrolled in.
(47) ☐☐☐ (49) Months — Part-time work experience related to program now enrolled in.
(50) ☐☐☐ (52) Months — Full-time work experience related to program now enrolled in.

25. If you have previously attended an *Area Vocational School* in Minnesota, which one was it? Use the code number from Question 11.

(53)(54) ☐☐ Code What was the date you left? (55)(56) ☐☐ Month (57)(58) ☐☐ Year

- -

FOR OFFICE USE ONLY: U.S. Office of Education Code for program enrolled in. * (59) ☐☐ * ☐☐☐☐ (64)

MSAT scores: Raw score * (65)(66) ☐☐ Percentile rank * (67)(68) ☐☐

High School Percentile Rank: * (69)(70) ☐☐

(1)(2) * 0 5

General Aptitude Test Battery (GATB): G * (9) ☐☐☐ (11) N * (12) ☐☐☐ (14) P * (15) ☐☐☐ (17) K * (18) ☐☐☐ (20)
V * (21) ☐☐☐ (23) S * (24) ☐☐☐ (26) Q * (27) ☐☐☐ (29)

*Asterisks indicate red boxes.

APPENDIX B

TERMINATION REPORT FORM

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Form 7173T

Vocational Follow-Up System
Room 302, 1507 University Ave. SE
University of Minnesota
Minneapolis, Minnesota 55414

TERMINATION REPORT FORM

1 3 8
*☐0 ☐6 ☐ ☐ *☐ ☐ ☐ ☐

NOTE: Red squares are for office use only

STUDENT'S NAME ______________________________
Last First Middle Initial or Maiden Name

AREA VOC.–TECH. INSTITUTE ______________________________
Name

PROGRAM STUDENT TERMINATED ______________________________ 9 11 *☐ ☐ ☐
Official Curriculum Title

CHANGE OF STATUS
(Check one)

Date: 12 ☐ ☐ month 15 ☐ ☐ year

16
☐ 1 Student withdrew (see back of this page for reasons. Place code in this square.) 17 ☐

16
☐ 2 Student changed program

TO ______________________________ *18 ☐ ☐ ☐ 20
Curriculum

16
☐ 3 Student (a) completed training objective (student accepted employment in a job directly related to student's AVTI program without graduating), or (b) received a trade certificate.

16
☐ 4 Student graduated.

*Asterisks indicate red boxes.

REASON FOR WITHDRAWAL CODE

(Select one and record on other side)

1. UNSATISFACTORY PROGRAM PERFORMANCE

   e.g.
   - _ poor grades – lack of progress
   - _ absent too frequently
   - _ could not adjust to training program
   - _ lack of educational interest
   - _ etc.

2. ECONOMIC REASONS

   e.g.
   - _ insufficient funds
   - _ accepted a full-time job not related to his AVTS program
   - _ etc.

3. ENTERED THE ARMED FORCES

4. PERSONAL PROBLEMS

   e.g.
   - _ family problems
   - _ health-illness-or death
   - _ marriage
   - _ moved from area
   - _ pregnancy
   - _ etc.

5. STUDENT TRANSFERRED TO OTHER AVTS

6. STUDENT TRANSFERRED TO JUNIOR COLLEGE

7. STUDENT TRANSFERRED TO COLLEGE OR UNIVERSITY

8. STUDENT TRANSFERRED TO INSTITUTION OTHER THAN THOSE MENTIONED IN 5, 6, or 7.

9. REASON UNKNOWN

   e.g.
   - _ no reason given by student
   - _ non-interpretable reason
   - _ etc.

APPENDIX C

FOLLOW-UP QUESTIONNAIRE

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(1) *0 7 (3) *☐☐ (8) *☐☐☐☐ (11) *☐☐☐ (13) *☐☐

Vocational Follow-Up System
Room 302, 1507 University Avenue S.E.
University of Minnesota
Minneapolis, Minnesota 55414

PLEASE LEAVE ALL RED SQUARES BLANK

(14) Date *☐☐ Month (17) *☐☐ Year

FOLLOW-UP QUESTIONNAIRE

ALL RESPONSES WHICH YOU GIVE WILL BE KEPT STRICTLY CONFIDENTIAL

GENERAL DIRECTIONS: Please complete ALL sections that apply. When you have completed the form return it in the enclosed return-addressed, stamped envelope. Your frank response is very important in order that the area vocational-technical institutes may continue to improve their programs.

I. PERSONAL INFORMATION

A. Name ______________ (Last) ______________ (First) ______________ (Middle)

B. Soc. Sec. No. (18) ☐☐☐-☐☐-☐☐☐☐ (26)

C. Present Address ______________________________ (Street or Rural Route)

______________ (City) ______________ (State) ______________ (zip code)

D. Home Phone ______________ (area code) Work Phone ______________ (area code)

II. ADDITIONAL TRAINING

A. Since attending the area vocational-technical institute, what further educational training have you taken part in? (You may check more than one.)

(27) ☐1 None

(28) ☐1 On-the-job training (employer-sponsored training program)

(29) ☐1 Public area vocational school programs

(30) ☐1 Private vocational programs

(31) ☐1 University, college and/or junior college programs

(32) ☐1 Apprenticeship

(33) ☐1 Specialized occupational military training

(34) ☐1 Other ______________ (specify)

III. EMPLOYMENT INFORMATION – Present status

A. Are you presently employed, unemployed or unavailable for employment? (Check *only* one of employed, unemployed, or unavailable for employment.)

☐ Employed * (35) ☐

☐ Unemployed (You are actively looking for a job but cannot find one.)

☐ Unavailable for employment (You cannot accept a job for one of the following reasons. Please check appropriate reason.)

(36)
- ☐1 Military
- ☐2 Further training or education
- ☐3 Illness

(36)
- ☐4 Housewife or pregnancy
- ☐5 Presently not working and not interested in employment
- ☐6 Other ______________ (specify)

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*Asterisks indicate red boxes.

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IV. JOB INFORMATION: (IF YOU HAVE NOT BEEN EMPLOYED AT ANY TIME SINCE GRADUATION FROM THE AREA VOCATIONAL-TECHNICAL INSTITUTE, SKIP TO SECTION IX, p. 4.)

DIRECTIONS:
1. If you were employed at any time since graduating from the area vocational-technical institute, *complete the following section of the questionnaire.*
2. Please supply the requested information for each of the following jobs held during the time since graduating from the area vocational-technical institute. (Include names and addresses.)

(1) First Job (first job after leaving vocational school)

(37) * ☐☐☐☐☐ (41)

(42) * ☐☐☐ (44)

(45) * ☐ (46) ☐

Firm Name ____________________

Firm Address ____________________

____

City ____________________

Job Title ____________________

Job Duties ____________________

____

Immediate Supervisor ____________________

Check one:
(47)
1 Full-time job
2 Part-time job

Check one:
☐ Job related to training
☐ Job not related to training

Number of *months* in this job since graduation from vocational school
(48)(49) ☐☐

(2) Present Job (job you are presently employed in. If same as first job, write SAME.)

(50) * ☐☐☐☐☐ (54)

(55) * ☐☐☐ (57)

(58) * ☐ (59) * ☐

Firm Name ____________________

Firm Address ____________________

____

City ____________________

Job Title ____________________

Job Duties ____________________

____

Immediate Supervisor ____________________

Check one:
(60)
1 Full-time job
2 Part-time job

Check one:
☐ Job related to training
☐ Job not related to training

Number of *months* in this job since graduation from vocational school
(61)(62) ☐☐

(3) How many jobs, including your first and present job, have you had since leaving the area vocational-technical institute? (63) ☐

V. ADVANCEMENT INFORMATION

A. Have you had a formal advancement in job classification (other than just salary increases) since taking your first job after leaving the area vocational-technical institute?

YES (64) 1 NO (64) 2

B. NOTE: The following item need not be completed if you prefer not to complete it. Please do not include overtime when calculating your monthly salary. (Check the appropriate squares.)

	Under $250	250-299	300-349	350-399	400-449	450-499	500-549	550-599	600-649	650-699	700+	
First Job Monthly Salary Range												(65-66)
Present Job Monthly Salary Range												(67-68)
	01	02	03	04	05	06	07	08	09	10	11	

*Asterisks indicate red boxes.

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(1) (2)
*☐0 ☐8

VI. JOB SATISFACTION SURVEY: (IF YOU ARE NOT PRESENTLY EMPLOYED, SKIP TO SECTION VII.)

DIRECTIONS: The purpose of this survey is to enable you to express your feelings of satisfaction or dissatisfaction with your present job. Please answer all questions by placing an "X" in the appropriate square.

A. How do you feel about your present job?

(9)

☐1 Like it very much

☐2 Like it somewhat

☐3 Neither like nor dislike it

☐4 Dislike it somewhat

☐5 Dislike it very much

B. Considering the characteristics of your present job, rate the degree to which you are satisfied with each of the following:

	Sat-isfied	Not Sure	Dissat-isfied			Sat-isfied	Not Sure	Dissat-isfied	
1. Salary	☐1	☐2	☐3	(10)	7. Pace (speed) of work	☐1	☐2	☐3	(16)
2. Fringe benefits	☐1	☐2	☐3	(11)	8. Facilities and equipment with which to do the job	☐1	☐2	☐3	(17)
3. Potential for advancement	☐1	☐2	☐3	(12)	9. Working conditions	☐1	☐2	☐3	(18)
4. Supervision and management	☐1	☐2	☐3	(13)	10. Variety of work tasks	☐1	☐2	☐3	(19)
5. Co-workers	☐1	☐2	☐3	(14)	11. Job security	☐1	☐2	☐3	(20)
6. Company policies and practices	☐1	☐2	☐3	(15)	12. Safety conditions	☐1	☐2	☐3	(21)

TRAINING PROGRAM QUESTIONNAIRE: (IF YOU ARE PRESENTLY EMPLOYED OR HAVE BEEN EMPLOYED AT ANY TIME DURING THE YEAR SINCE GRADUATION FROM THE AREA VOCATIONAL-TECHNICAL INSTITUTE, COMPLETE THIS SECTION OF THE QUESTIONNAIRE.)

DIRECTIONS: Please answer all of the following questions concerning the quality of the curriculum and the quality of the facilities and equipment associated with the program from which you graduated. Place an "X" in the appropriate square.

VII. CURRICULUM

A. In light of your experience on the job, how do you feel about the training you received in basic job-related (performance) skills at the area vocational-technical institute?

(22) ☐1 Excellent
(22) ☐2 Very good
(22) ☐3 Adequate
(22) ☐4 Inadequate

B. In light of your experiences on the job, how do you feel about the training you received in job-related general technical knowledge at the area vocational-technical institute?

(23) ☐1 Excellent
(23) ☐2 Very good
(23) ☐3 Adequate
(23) ☐4 Inadequate

VIII. FACILITIES AND EQUIPMENT

A. The equipment at the area vocational-technical institute in my training area was such that:

(24)
☐1 I found it very easy to adapt to the equipment on the job.
☐2 I had some problems adapting to the equipment on the job.
(24)
☐3 I found it very difficult to adapt to the equipment on the job.

B. In comparison to the facilities and equipment used on your present job, how would you rate your area vocational-technical institute facilities and equipment?

(25)
☐1 Area vocational-technical institute facilities and equipment were superior to those on the job.
☐2 Area vocational-technical institute facilities and equipment were similar to those on the job.
☐3 Area vocational-technical institute facilities and equipment were inferior to those on the job.

*Asterisk indicates red boxes.

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THIS SECTION IS TO BE COMPLETED BY ALL

DIRECTIONS: Please answer all of the following questions concerning the quality of instruction and the quality of the school and community services associated with the school from which you graduated. Place an "X" in the appropriate square.

IX. INSTRUCTION

A. How would you rate the teaching quality of instructors in your training program at the area vocational-technical institute?

(26) ☐1 Most of the instructors taught very well.
(26) ☐2 About the same number taught well as did not.
(26) ☐3 Most of the instructors did not teach well.

B. How would you rate the knowledge your instructors at the area vocational-technical institute possessed about their field?

(27) ☐1 Most were very knowledgeable.
(27) ☐2 About the same number were knowledgeable as were not.
(27) ☐3 Most were not knowledgeable.

C. How would you rate the interest shown by your instructors in your work progress at the area vocational-technical institute?

(28) ☐1 Most instructors were very interested in my progress.
(28) ☐2 Most instructors were somewhat interested in my progress
(28) ☐3 Most instructors did not seem interested in my progress.

D. How would you rate the extent to which your instructors at the area vocational-technical institute were up-to-date in their fields?

(29) ☐1 Most instructors were up-to-date.
(29) ☐2 About the same number were up-to-date as were not.
(29) ☐3 Most instructors were not up-to-date.

X. If you could start all over again, would you choose the same training program you received training in at the area vocational-technical institute?

YES (30) ☐1 NO (30) ☐2

XI. SCHOOL AND COMMUNITY SERVICES

A. Who was the *greatest* help to you in securing your first job? (Check one.)

(31) ☐1 Instructor, or other area vocational-technical institute personnel
☐2 Private employment agency
☐3 Relatives or friends
(31) ☐4 State employment agency
☐5 Other ______________________ (specify)
☐6 Does not apply (I have not been employed during the year)

B. How would you rate the *quality* of the following services as provided by the *area vocational-technical institute*? If you did not take advantage of the service, or if the service was not available, check "does not apply." (Please check only one square for each item.)

	Excel-lent	Good	Poor	Does not apply	
1. Job Placement	☐1	☐2	☐3	☐4	(32)
2. Counseling with personal problems	☐1	☐2	☐3	☐4	(33)
3. Help in making career decisions	☐1	☐2	☐3	☐4	(34)
4. Help in securing part-time employment	☐1	☐2	☐3	☐4	(35)
5. Help in obtaining financial assistance	☐1	☐2	☐3	☐4	(36)
6. Help in securing housing	☐1	☐2	☐3	☐4	(37)
7. Youth organizations	☐1	☐2	☐3	☐4	(38)
8. Recreational programs	☐1	☐2	☐3	☐4	(39)
9. Study, library and other learning resource facilities	☐1	☐2	☐3	☐4	(40)
10. Health services	☐1	☐2	☐3	☐4	(41)

C. How would you rate the *quality* of the services and facilities provided by the *community* in which the vocational school is located? (Check appropriate square for each of the items.)

	Excel-lent	Good	Poor	Does not apply	
1. Housing	☐1	☐2	☐3	☐4	(42)
2. Job opportunities	☐1	☐2	☐3	☐4	(43)
3. Recreation facilities	☐1	☐2	☐3	☐4	(44)

APPENDIX D

EMPLOYER QUESTIONNAIRE

Vocational Follow-Up System
Room 302, 1507 University Avenue S.E.
University of Minnesota
Minneapolis, Minnesota 55414

______________ 19 ____

ALL RESPONSES YOU GIVE WILL BE KEPT STRICTLY CONFIDENTIAL

EMPLOYER QUESTIONNAIRE

DIRECTIONS: Please complete ALL sections of this form even if the employee no longer works for your firm. When you have completed the form return it in the enclosed return-addressed, stamped envelope. Your responses will in no way affect the employee.

I. PERSONAL INFORMATION

A. Employee name ______________________________
(Last) (First) (Middle)

B. Indicated Employer ______________________ City ______________

II. EMPLOYMENT INFORMATION

If the employee has worked or works for your firm, please have a supervisor familiar with the work of the employee fill out this questionnaire.

Supervisor filling out form

1. Name ______________________________ Date ____________
(Last) (First) (Middle)

2. Position ______________________________

PLEASE COMPLETE REMAINING PORTIONS OF THIS QUESTIONNAIRE

Not to be reproduced or used without written permission from the Vocational Follow-Up System.

(1)	(3)	(8)	(11)	(12)
0 9	☐☐	☐☐☐☐	☐☐☐	☐ (leave blank)

EMPLOYEE PERFORMANCE SURVEY

DIRECTIONS: Please indicate your satisfaction with the employee as compared with other workers in the same work group. If the worker is the only person employed with your firm, compare him with others who have worked in the same position. This information will be kept strictly confidential. Please respond to all questions.

I. Total number of *months* employee has been employed by your firm . . . ☐☐ (13-14)

PLEASE RESPOND TO THE FOLLOWING QUESTIONS BY PLACING AN "X" IN THE APPROPRIATE SQUARE

II. In comparison with other workers in the same work group, how would you rate the employee on each of the following characteristics?

	above average	about average	below average	
1. The quality of employee's work	1	2	3	(15)
2. The quantity of employee's work	1	2	3	(16)
3. The degree to which the employee possesses specific job-related knowledge important to success on this job	1	2	3	(17)
4. The degree to which the employee is able to operate the equipment and apparatus used on the job	1	2	3	(18)
5. The degree to which the employee possesses basic reading, verbal and computational skills	1	2	3	(19)

III. In comparison to others in the employee's work group, how would you rate the employee on each of the following characteristics?

	above average	about average	below average	
1. Willingness to accept responsibility	1	2	3	(20)
2. Punctuality	1	2	3	(21)
3. Ability to work without supervision	1	2	3	(22)
4. Willingness to learn and improve	1	2	3	(23)
5. Cooperation with co-workers	1	2	3	(24)
6. Cooperation with management	1	2	3	(25)
7. Compliance with company policies, rules, and practices	1	2	3	(26)
8. Work attendance	1	2	3	(27)

IV. In comparison with other workers in the same work group, how would you rate the employee's over-all competency, effectiveness, proficiency, general over-all work attitudes, and other elements of successful job performance?

(28)

1 In the top 1/4

2 In the top 1/2 but not among the top 1/4

3 In the bottom 1/2 but not among the lowest 1/4

4 In the lowest 1/4

OKLAHOMA'S STUDENT ACCOUNTING SYSTEM

J. B. MORTON

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OVERVIEW OF THE TOTAL MANAGEMENT INFORMATION SYSTEMS

Historical Development

The Management Information System in Oklahoma has undergone a great deal of development and refinement in recent years. The financial system has been in existence longer than any other system in Oklahoma, and early financial records were kept by the pen and ink system. In 1968, Oklahoma moved toward computerizing its system. Also in 1968, with attempts to develop the Occupational Training Information System which included the Student Accounting System, the present Management Information System began its evolution to its present form. In 1970, the Research Coordinating Unit (RCU) was made a part of the Oklahoma State Department of Vocational and Technical Education and became known as the Division of Research, Planning, and Evaluation (RP&E). Other systems have been added to give the administrative information that the State Department needs to make management decisions.

Organization and Design

Due to the structure of its organization, the State Department allows a change to be made quicker and easier than it can be made in some states. The State Department is a separate agency in the State of Oklahoma. The organizational structure of the State Department is shown in Figure 1. It indicates that there is a Director, Francis Tuttle, and a Deputy Director, Arch Alexander, who has the responsibility for administrative divisions which include special schools, public information, and curriculum and instructional materials development. Under the Director and Deputy Director, there are three separate assistant directors with specific responsibilities. Byrle Killian, Assistant State Director for the Educational Services and Special Programs, is responsible for all of the regular educational programs in the secondary, postsecondary, and adult teaching areas. Assistant State Director, William Stevenson, has as his responsibilities the Division of Research, Planning, and Evaluation, which includes research, planning, evaluation, information services, and special projects. Larry Hansen is the Assistant Director in charge of the Business, Finance, and Purchasing area. This includes the accounting for all inputs and expenditures of all invoices, facilities and equipment, purchasing, and the equipment pool. The organizational structure of the total Management Information System falls within three of these areas of responsibilities.

Research, Planning, and Evaluation has the responsibility for most of the Management Information System in that it has the responsibility of the Student Accounting System, the Occupational Training Information System (OTIS), the Teacher Information System evaluation, and population information. Finance has the responsibility for the financial system and facilities and equipment. The supportive and administrative services have the responsibility for curriculum development.

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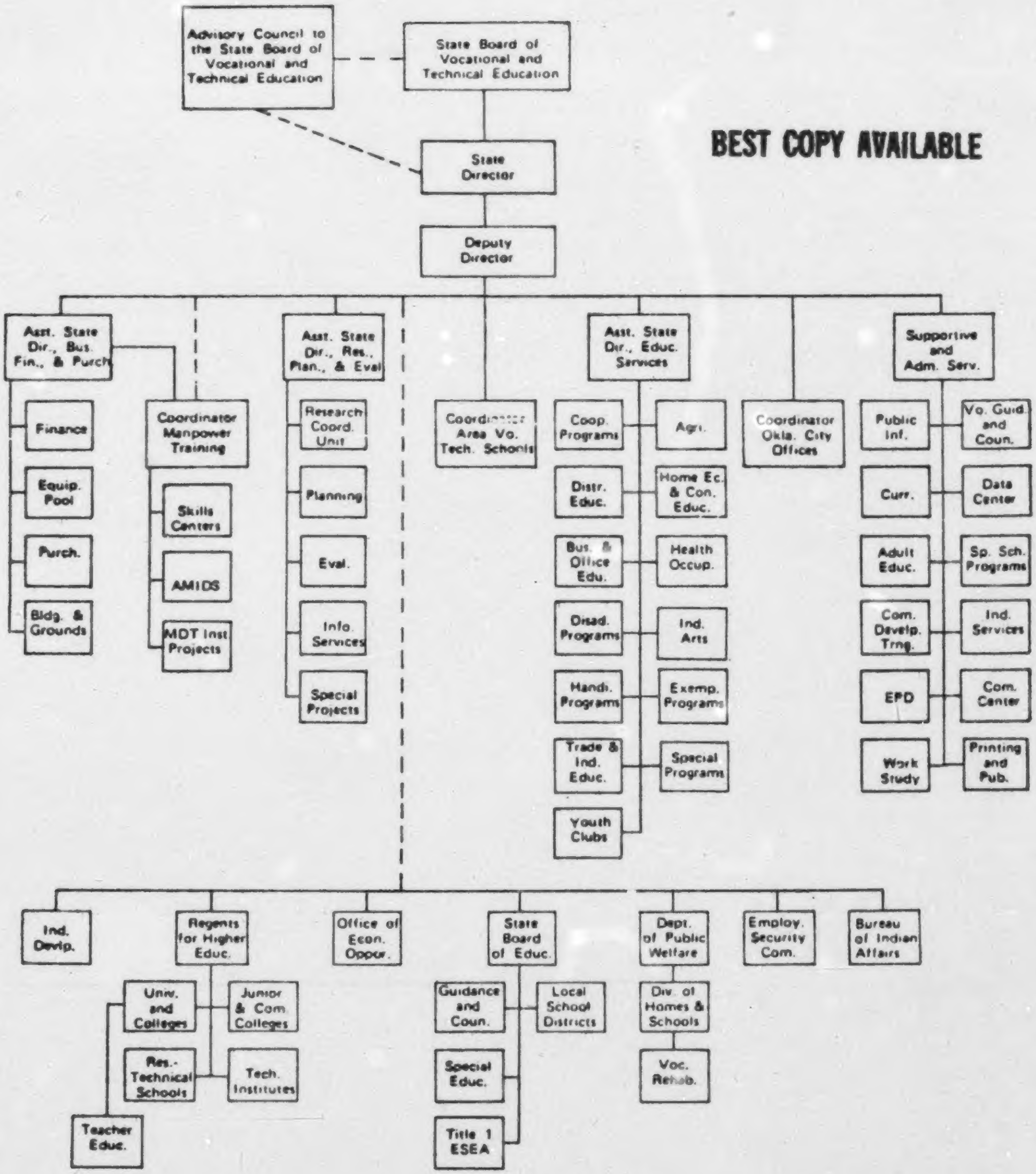

Figure 1. Organizational Chart for State Department of Vocational and Technical Education

Oklahoma's Management Information System chart is shown in Figure 2. Below is an explanation of the components of this chart.

Occupational Training Information System. OTIS is an annual publication giving gross demand, gross supply, and net demand on 218 occupations for the state and 11 substate planning regions. One of the major uses of this information is in program planning.

Curriculum Development. Curriculum is developed on performance objectives for vocational-technical programs for about 60 percent of the teaching time. All materials are coordinated with the teachers, industry, supervisors, and teacher-educators. Teaching materials have been developed to cover 67.5 percent of the secondary vocational students enrolled. This material is used at all levels of vocational-technical education. Special materials are developed for some adult classes.

Teacher Information System. Information for this subsystem originates from existing systems in the State Department of Education, the State Teacher Retirement System, and teacher certification.

Facilities and Equipment. All facilities and equipment purchased from federal or state (other than district) money and equipment obtained from the U. S. surplus and excess properties are computerized to make annual inventory checks with the school districts in the state. All expenditures are computerized for administrative use.

Evaluation. Oklahoma is committed to provide an annual on-site evaluation of 20 percent of the secondary programs. The evaluation results in a product index for each program. This product index makes supervisors and administrators aware of the value of the programs to society.

Population. This includes all of the information that can be compiled on the population in Oklahoma.

Current Capabilities and Future Plans

We feel that since 1968 we have made tremendous progress in our Management Information System in Oklahoma. The plans for the future include further development of our present system and the development of other systems for management. A good example of this is the linear programming project which attempts to optimize program costs and program needs. We feel that with the management inputs that we have in Oklahoma, the linear programming project should develop into an excellent management tool. Other systems in management that we might be able to add are being contemplated.

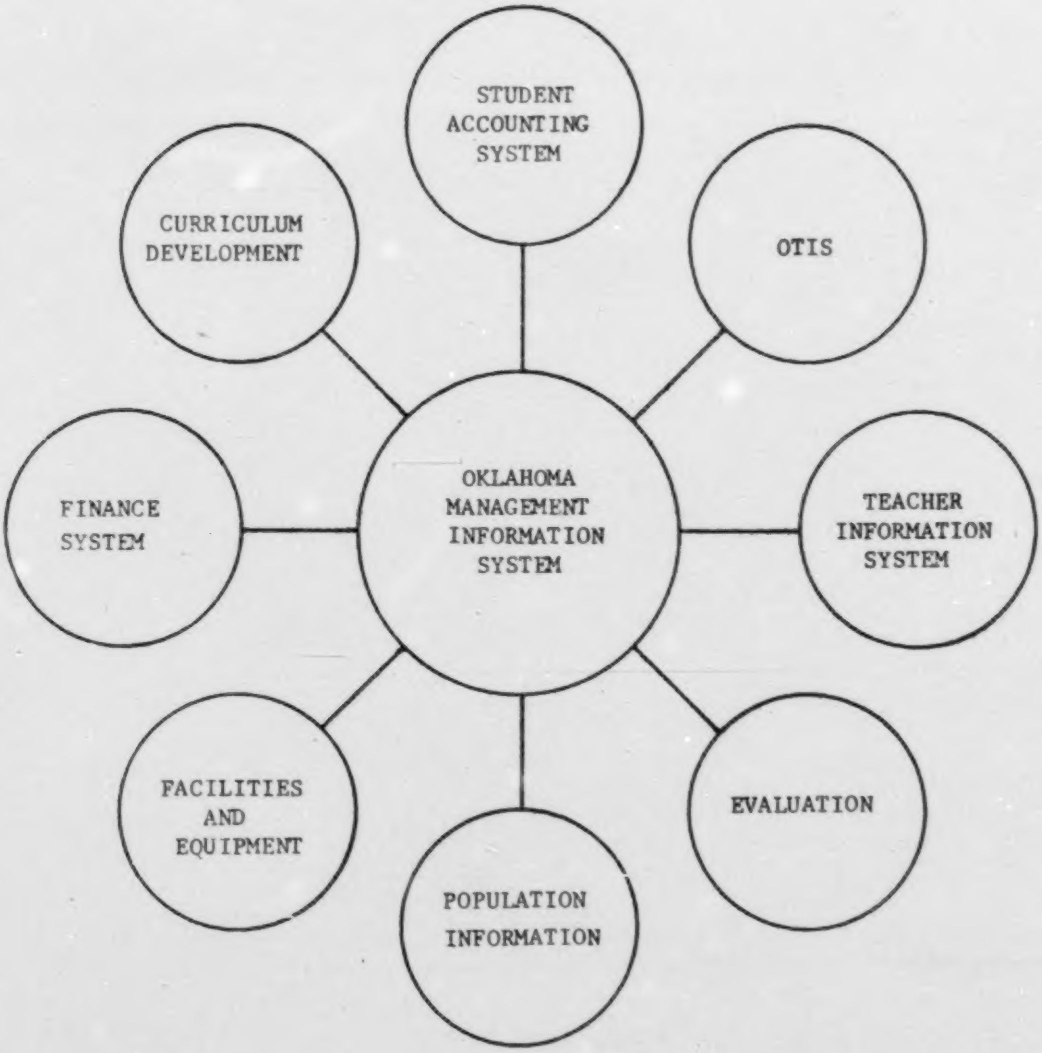

Figure 2. Oklahoma Management Information System

Overview of the Student Accounting System

Organization

Oklahoma, like most other states, has tried several approaches to gathering student data. Past efforts have been oriented toward a "program area" approach, with each state supervisor responsible for reporting all programs under his control. The result of these efforts was a lack of uniformity in data and a great deal of "hand" processing.

In 1968 the Oklahoma Research Coordinating Unit and Oklahoma State University began to design a comprehensive information system for manpower planners in Oklahoma. This system was called the Occupational Training Information System (OTIS). One part of this project involved a Student Accounting System. In the spring of 1970, OTIS and the Student Accounting System became the responsibility of the Oklahoma State Department of Vocational and Technical Education.

The Student Accounting System designed by OTIS and the procedures used by the RCU proved to be satisfactory in many respects. The procedures and methods are still evolving toward a more accurate system with less cost. Teachers, supervisors, and directors were involved in redesigning the Student Accounting System, and Oklahoma was one of the first states, if not the first in the United States, to develop an automated Student Accounting System. This was done by the personnel within the RCU unit. It took one and one-half full-time equivalents almost a year to develop the system at an estimated development cost of $17,500.

The Division of Research, Planning, and Evaluation is responsible for the Student Accounting System. To make it function, it is necessary to depend on the cooperation of all areas of teaching. Each of the supervisors and teachers has a responsibility to the Student Accounting System to see that correct information is available on each student.

Objectives

The Student Accounting System objectives include methods for collecting, processing, and analyzing enrollment, completion, and follow-up data. These methods should incorporate the optimum compromise among time, cost, and accuracy.

Relationship of the Subsystem to Decision-Makers

The Student Accounting System is used in the State Plan to indicate the number of students enrolled, completed, and working in the area for which trained, as well as the number projected to be trained. It is used by the administration to provide information to state and federal legislators on students and programs. This information is also used by the State Department's Public Information Unit to give facts concerning vocational-technical programs.

The Student Accounting System is the basis for OTIS, evaluation, and other population information in the Management Information System. The information that is developed from the Student Accounting System is used as the basis for information to make decisions in the State Department of Vocational and Technical Education.

The Student Accounting System is used a great deal in the State Department. It is used on a daily basis by supervisors of various divisions to check the number of students enrolled in each class and to control the size of the class. It is an input into the evaluation system to give a product index for a program, computed by using the follow-up information.

The Student Accounting System is a part of the long-range planning program in the State Department of Vocational and Technical Education. It is necessary to know how many students enroll in each of the programs, what the present and projected manpower needs are in Oklahoma, the percentage of students available for placement by each occupational objective, and the resulting number of programs that will be needed to meet the manpower demands. Without the Student Accounting System information, it would be difficult for the State Department of Vocational and Technical Education to supply state legislators with the information they need each year. We are able to tell the legislators what is happening to the vocational-technical students in Oklahoma, and there is not another educational agency in Oklahoma that can give this kind of information. Since 1968 we have had a 242 percent increase in the amount of state monies going into vocational-technical education. This can be attributed to the fact that we have information that will sell the state legislators and the public on the idea that we are placing vocational-technical trained people on jobs.

The State Department of Vocational and Technical Education uses the Student Accounting System to report to the State Board of Vocational and Technical Education in Oklahoma. The Student Accounting System is also used in developing reports to the U. S. Office of Education regarding enrollment, completion, and follow-up information on students. The Student Accounting System is used to give up-to-date supply input into the OTIS report each year.

Operational Description of the Student Accounting System

Input[1]

It is important to all the personnel in the State Department of Vocational and Technical Education that the Student Accounting System

---

[1] See Table 1.

Table 1. Input Data

Input	Source of Data	Method of Collection	Method of Entry	Frequency of Collection	Output Report Number and Destination
Enrollment Form	Teacher	Mailout Survey	Punch card	Yearly or as class begins	3 SMDIV 5 SMDIST 1 U. S. Office of Education 3138 3132 7 Ethnic 3 Class Roster
Completion Form	Teacher	Mailout Survey	Punch card	Yearly or as class ends	1 SMDIV 1 SMDIST 1 U. S. Office of Education 3138 7 Ethnic
Follow-up Form	Teacher	Mailout Survey	Punch card	Yearly for 1st, 3rd, and 5th year after completion	1 SMDIV 1 SMDIST 1 U. S. Office of Education 3139 7 Ethnic

fit within its present operating structure. The important aspect of this is that the supervisors and coordinators continue contacts with their teachers. Subsequently, RP&E delivers its enrollment, completion and follow-up forms (Appendix A, B, and C) to the state supervisors, area school coordinators, Special Programs coordinator, local school directors, and the State Regents for Higher Education, hereafter referred to as the contact person.

The contact person is responsible for delivering these forms to the teachers and seeing that they are properly filled out and returned in an accurate and correct form to the Division of Research, Planning, and Evaluation. The flow chart for this operation is shown in Appendix D. When these forms are returned to the contact person, someone in that unit is responsible for reviewing the form to make sure it is correct before sending it to RP&E.

When the enrollment form comes to RP&E, the forms are visually checked for accuracy before being sent to keypunching. Keypunching is completed for each individual student based on the format shown in Appendix D. After keypunching, the information on the cards is computer audited for accuracy. The correct information is then placed on a work tape while the incorrect information is printed on a computer printout. Inaccuracies are corrected from the original enrollment copy in the RP&E office. The information is then reaudited and placed on the work tape. All correct student information is finally placed on the master enrollment tape.

The completion report form is a computerized listing of the classes for the teacher to indicate, by code, the student's status at the end of the school year.

The follow-up report form is a computerized listing of those students who have completed the training program as indicated by the completion report. The teacher indicates, by code, the student's status six months after completing the training program.

There is a question among some states whether follow-up information should be collected from the teacher or the student. In Oklahoma, the State Department has emphasized to the teachers the importance of their being responsible for helping the student get a job in the area in which he is trained. They are also responsible for knowing where their students are so that they can give an accurate report on follow-up information. In order for us to make a comparison and take whatever action is necessary, we complete a sample survey of students every three years. This sample is taken to enable us to compare by occupational objectives and by division the similarity of the teachers' to the students' follow-up responses. At this time, we are in the process of completing a parallel follow-up study. When this study was completed three years ago, the results indicated that there was not a significant difference in the information which the student and the teacher gave. The teacher, however, was much more knowledgeable about whether the work the student was doing was related to the training he had received. Also, with the teacher filling out the follow-up information, the cost has proven to be less and the response rate has proven to be much higher.

The Student Accounting System is funded through the regular budget for the Division of Research, Planning, and Evaluation. The money comes from both federal and state sources.

The annual operation cost of the Student Accounting System to the RP&E Division is as follows:

Student Accounting System Personnel	
Full-time	$ 8,000
Part-time help	390
Travel	1,716
Computer Time - 26 hrs. at $35.00	910
Keypunch - 100,000 cards at $.04	4,000
Interpret cards, completion of follow-up - 24 hours at $4.00	96
TOTAL	$15,112

The cost per student at 97,000 students would be $.16 per student.

Table 2 indicates the total resource requirements and estimates on time and cost. All of these costs are not indicated in our annual operating cost because they are not a direct cost. Also, we consider that the teachers and secretaries are being paid to do this work as part of their total responsibilities.

The Oklahoma State Department of Vocational and Technical Education is part owner of an RCA Spectra 70 which has a capacity of 65K. With this limited core capacity, we are not able to program on a matrix system. We program for the questions that we need answered; therefore, the primary function of our first program on our Student Accounting System was to create the U. S. Office of Education reports. Other programs were developed to give the administration answers to the questions most often asked. At this time, the general consensus is that the Student Accounting System's program meets most of the needs of the State Department.

At the present time, the Oklahoma Student Accounting System consists of 15 data elements on each student. The system has the capacity for an unlimited amount of information per student input and is designed so that variations can be made easily on the data requested on each student. Future plans for the Student Accounting System will be toward further refinement of individual information in the system. We plan to move to a system whereby a student is enrolled only one time for a multiyear program. The enrollment, completion, and follow-up data will all be collected at the same time.

Table 2. Resource Requirements

Operation	Personnel			Hardware	Software
	Number	Time	Estimated Cost		
Data Collection					
Enrollment	1811½	1670/hrs.	$ 6,228	Keypunch Card Readers Tape Drive	- - -
Completion	1811½	710/hrs.	$ 2,518	Keypunch Card Readers Tape Drive	- - -
Follow-up	1811½	2140/hrs.	$13,118	Keypunch Card Readers Tape Drive	
Data Processing	1	50/hrs.	$ 4,510	Keypunch	15 core
Data Storage	1	41/hrs.	$ 185	Tape	
Date Display and Reports	1	55/hrs.	$ 685	Tape Printer Card Punch Card Reader	29 core

Output[2]

The reports generated by the Student Accounting System are:

Summary by Division. This is a display of each division by school and class, including the total enrollment, male and female, grade level, race, disadvantaged, and handicapped, and total for each column.

Summary by District. This is a display by each school district by school and class, of the total enrollment, male and female, grade level, race, disadvantaged, and handicapped, and total for each column.

U. S. Office of Education Reports.

3138 - indicates enrollment by occupational objectives for each division, the level of training (secondary, postsecondary, and adult) for the state and two SMSA's in Oklahoma.

3139 - indicates follow-up information by occupational objectives and by division for secondary, postsecondary, and adult level for the state.

3132 - indicates enrollment by level for the state's two SMSAs and non-SMSAs.

Completion.

1. The completion form is a computerized report that is given to the teacher for his proper coding of the student's status at the end of the school year.
2. A completion report indicates by school the number of students in each completion code.
3. A completion report by division indicates the number of students for each completion code by school for that division.

Follow-Up.

1. A follow-up report form is a computerized listing of students for the teacher to indicate, by code, the student's status after completion of training.
2. A follow-up report by district indicates, by school, the number of students in each of the follow-up codes.
3. A follow-up report by division indicates the number of students for each follow-up code by school for that division.

---

[2] See Table 3.

Table 3. Output Data

Output	Frequency of Report	Organizations and Officers Who Receive Reports on a Regular Basis	Organizations and Officers Requesting Reports
SMDIV			
Enrollment	Annually	Director, State Supervisor, Coordinator	Director, State Supervisor, Coordinator
Completion	Annually	Director, State Supervisor, Coordinator	Director, State Supervisor, Coordinator
Follow-up	Annually	Director, State Supervisor, Coordinator	Director, State Supervisor, Coordinator
SMDIST			
Enrollment	Annually	Director, State Supervisor, Coordinator, Local Director and Local Superintendent	Director, State Supervisor Coordinator, Local Director and Local Superintendent
Completion	Annually	Director, State Supervisor, Coordinator	Director, State Supervisor, Coordinator
Follow-up	Annually	Director, State Supervisor, Coordinator	Director, State Supervisor, Coordinator
U. S. Office of Education			
3138	Annually	Directors	Directors
3139	Annually	Directors	Directors
3132	Annually	Directors	Directors

Table 3 (continued)

Output	Frequency of Report	Organizations and Officers Who Receive Reports on a Regular Basis	Organizations and Officers Requesting Reports
ETHNIC	Annually	Director, State Supervisor, Coordinator	Director, State Supervisor, Coordinator
Class Roster	Annually	RP&E	Used for reference and research information

Ethnic. The ethnic report is a matrix indicating race by enrollment total, male and female, grade level, disadvantaged and handicapped; this is shown by enrollment, completion, and follow-up for secondary, postsecondary, and adult for each division.

Class Roster. This lists all students by class with total individual student information.

General Discussion and Critique of the Student Accounting System

The general consensus among the State Department of Vocational and Technical Education personnel and teachers is that the Student Accounting System is doing an effective job and that it does fulfill its stated objective.

One of our biggest difficulties is getting the teachers to get information in on time. We continue to find additional needs for information that has not been programmed, such as programs which would give student and financial information on a single printout. We have made efforts to see that all systems within the Management Information System are compatible. The next step is to develop more programs utilizing the various systems.

Our experience with the optical scanner and our reasoning for going to keypunch indicate that there is nothing wrong with the optical scanning equipment if one or very few people are filling out the forms. When the students were filling out the forms and the teachers were supposed to be checking them, we were having (over the state) a 14.6 percent error on the first audit. We found it necessary to hire a clerk to search the school's file for the optical form that created the error using the bad record printout as a guide. On a field test with the same information, a data processing class keypunched the information from the optical scan forms and had a four percent error. The four percent error was a teacher error that could have been avoided if someone familiar with the code had looked at it before keypunching. After the field test, a feasibility study was made which determined that we could cut the cost of operation by $10,000 and improve our accuracy on the first audit by 13 percent. We are in our first year of using an enrollment form that is the teacher's responsibility. We are returning some of the forms to the teachers because of inaccuracies, so our enrollment numbers are behind this time last year. We do know, however, that what we do accept is correct, and we have great confidence that we have made a big step in improving our Student Accounting System.

APPENDICES

APPENDIX A

ENROLLMENT FORMS

BEST COPY AVAILABLE

ENROLLMENT FORM (CHECK ONE) SECONDARY ___ COLLEGIATE ___ FULL-TIME ADULT ___
STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION
DUE OCTOBER 1ST

School Name ______________________________

Class Name ______________________ See Guide Book Pg. 3

Teacher Name ______________________________

No. Enrolled in Class ____________ Date ____________

FOR STATE OFFICE USE ONLY

Batch No. ___ (55-57)

School Code ___ (33-41)

Class Code ___ (28-32)

Contract No. ___ (47-49)

STUDENT NAME				USE GUIDE BOOK				USE GUIDE BOOK				
1st Initial	2nd Initial	Last Name (Print or Type)	Social Security Number	Occupational Objective Code	Sex M or F	Age	Grade Level	Race	Econ/Acad Dis.	Men. Hand.	Phys. Hand.	Dis. or Hand.
1	2	3-12	13-21	22-27	42	43-44	45-46	50	51	52	53	54

WHITE COPY-RESEARCH DIVISION, YELLOW COPY-CONTACT PERSON, BLUE COPY-INSTRUCTOR

BEST COPY AVAILABLE

ENROLLMENT AND COMPLETION FORM PART-TIME ADULT
STATE DEPARTMENT OF VOCATIONAL AND TECHNICAL EDUCATION

DUE WITHIN THREE DAYS AFTER CLASS HAS ENDED

School Name ______________________________

Class Name ______________________ See Guide Book Pg. 7

Class Occupation Objective Code (See Guide Book) __________ 22-27

Teacher Name ______________________________

No. Enrolled in class ______________ Date ______________

FOR STATE OFFICE USE ONLY

Batch No. ______ (55-57)

School Code ______ (33-41)

Class Code ______ (28-32)

Contract No. ______ (47-49)

STUDENT NAME							SEE GUIDE BOOK					
1st Initial	2nd Initial	Last Name (Print or Type)	Social Security Number	Sex M or F	Age	Adult Prep (AP) or Adult Sup (AS)	Race	Econ/Acad Dis.	Men. Hand.	Phys. Hand.	Dis. or Hand.	Completion Code
1	2	3-12	13-21	42	43-44	45-46	50	51	52	53	54	80

WHITE COPY-RESEARCH DIVISION, YELLOW COPY-CONTACT PERSON, BLUE COPY-INSTRUCTOR

APPENDIX B

COMPLETION REPORT

```
                 OKLAHOMA STATE DEPARTMENT OF VOCATIONAL
                        AND TECHNICAL EDUCATION
              DIVISION OF RESEARCH, PLANNING AND EVALUATION
                      STILLWATER, OKLAHOMA 74074
                           COMPLETION REPORT

DIVISION XXXXXXXXXX
CLASS    XXXXXXXXXX                   --SPECIAL INSTRUCTIONS BELOW--
SCHOOL   XXXXXXXXXX
DATE     XX-XX-XX                     --SPECIAL INSTRUCTIONS BELOW--

COMPL       STUDENT                ****************************************
 CODE *       NAME                 ****************************************
      *                            **
      * B E MORTON 446-10-0013     ** FOR EACH STUDENT ON THIS REPORT ENTER
      *                            ** THE APPROPRIATE COMPLETION CODE IN
      * L S JACKSON 440-26-6713    ** THE COLUMN AT THE LEFT OF THIS REPORT.
      *                            ** USE THE COMPLETION CODES LISTED BELOW.
      * T B LANGDON 446-34-9810    ** (DUE WHEN SCHOOL CLOSES NO LATER THAN
      *                            **  MAY 31)
      * K R MEANS 440-97-8510      **
      *                            ** 1.  COMPLETED THE TRAINING PROGRAM
      * T S SMITH 442-60-1534      **     AND GRADUATED OR LEFT SCHOOL.
      *                            **
      * W A WYATT 432-72-0584      ** 2.  COMPLETED THE TRAINING PROGRAM
      *                            **     AND REMAINED IN THE SCHOOL IN
      * ADD STUDENTS IN YOUR CLASS **     OTHER COURSE WORK.
      *   NOT LISTED ABOVE.        **
      *                            ** 3.  COMPLETED THIS YEAR IN THE TRAIN-
      *                            **     ING PROGRAM AND PLAN TO CONTINUE
      *                            **     IN THE PROGRAM.
      *                            **
      *                            ** 4.  DROPPED OUT OF THE TRAINING PRO-
      *                            **     GRAM BUT CONTINUED IN SCHOOL.
      *                            **
      *                            ** 5.  TRANSFERRED TO ANOTHER SCHOOL.
      *                            **
      *                            ** 6.  DROPPED OUT OF SCHOOL AND IS
      *                            **     EMPLOYED FULL-TIME IN THE FIELD
      *                            **     FOR WHICH TRAINED.
      *                            **
      *                            ** 7.  DROPPED OUT OF SCHOOL AND IS NOT
      *                            **     EMPLOYED FULL-TIME IN THE FIELD
      *                            **     FOR WHICH TRAINED.
      *                            **
      *                            ** 8.  DROPPED OR TRANSFERRED AND STATUS
      *                            **     IS NOT KNOWN, OR IS DECEASED.
      *                            **
      *                            ** 9.  WAS NOT IN MY PROGRAM THIS YEAR.
      *                            ****************************************
      *                            ****************************************
TOTAL STUDENTS   6
```

APPENDIX C

FOLLOW-UP REPORT

```
                OKLAHOMA STATE DEPARTMENT OF VOCATIONAL
                       AND TECHNICAL EDUCATION
              DIVISION OF RESEARCH, PLANNING AND EVALUATION
                     STILLWATER, OKLAHOMA 74074
                          FOLLOW-UP REPORT

DIVISION XXXXXXXXXX
CLASS    XXXXXXXXXX                        --SPECIAL INSTRUCTIONS BELOW --
SCHOOL   XXXXXXXXXX
DATE     XX-XX-XX                          --SPECIAL INSTRUCTIONS BELOW--

FLWUP *    STUDENT                    ****************************************
 CODE *     NAME                      ****************************************
      *                               ** FOR EACH STUDENT ON THIS REPORT ENTER
      *  M A BROWN 424-86-9807        ** THE APPROPRIATE FOLLOWUP CODE AS OF
      *                               ** OCT 1ST IN THE COLUMN AT THE LEFT OF
      *  D BUSSEY 374-91-6123         ** THIS REPORT.  USE THE FOLLOWUP CODES
      *                               ** LISTED BELOW. (DUE OCT. 15).
      *  L L EDSON 348-76-0887        **
      *                               ** 0.   IN THE ARMED FORCES.
      *  B D GALLOWAY 872-06-3425     **
      *                               ** 1.   CONTINUING IN SCHOOL FULL-TIME IN
      *  J R GRAHAM 440-80-0001       **      A RELATED VOCATIONAL-TECHNICAL
      *                               **      FIELD.
      *  J M JOHNSON 440-81-1902      **
      *                               ** 2.   CONTINUING SCHOOL FULL-TIME IN A
      *  R P LIME 463-17-8507         **      NONRELATED VOCATIONAL-TECHNICAL
      *                               **      FIELD.
      *  E L PRICE 440-34-3914        **
      *                               ** 3.   NOT IN LABOR FORCE. (MARRIAGE,
      *  J E SMITH 446-48-8910        **      HEALTH, ETC.)
      *                               **
      *  J D WYATT 420-64-8760        ** 4.   WORKING FULL-TIME IN OCCUPATION
      *                               **      FOR WHICH TRAINED.
      * ADD STUDENTS IN YOUR CLASS    **
      *  NOT LISTED ABOVE             ** 5.   WORKING FULL-TIME IN OCCUPATION
      *                               **      RELATED IN TRAINING.
      *                               **
      *                               ** 6.   WORKING IN NONRELATED OCCUPATION
      *                               **      (FULL-TIME).
      *                               **
      *                               ** 7.   WORKING PART-TIME. (DOES NOT
      *                               **      INCLUDE THOSE IN SCHOOL.)
      *                               **
      *                               ** 8.   UNEMPLOYED, SEEKING EMPLOYMENT.
      *                               **
      *                               ** 9.   UNKNOWN.
      *                               **
      *                               ** Z.   DID NOT COMPLETE THE PROGRAM LAST
      *                               **      YEAR.
      *                               ****************************************
      *                               ****************************************
TOTAL STUDENTS  10
```

APPENDIX D

STUDENT ACCOUNTING SYSTEM ENROLLMENT FLOW CHART

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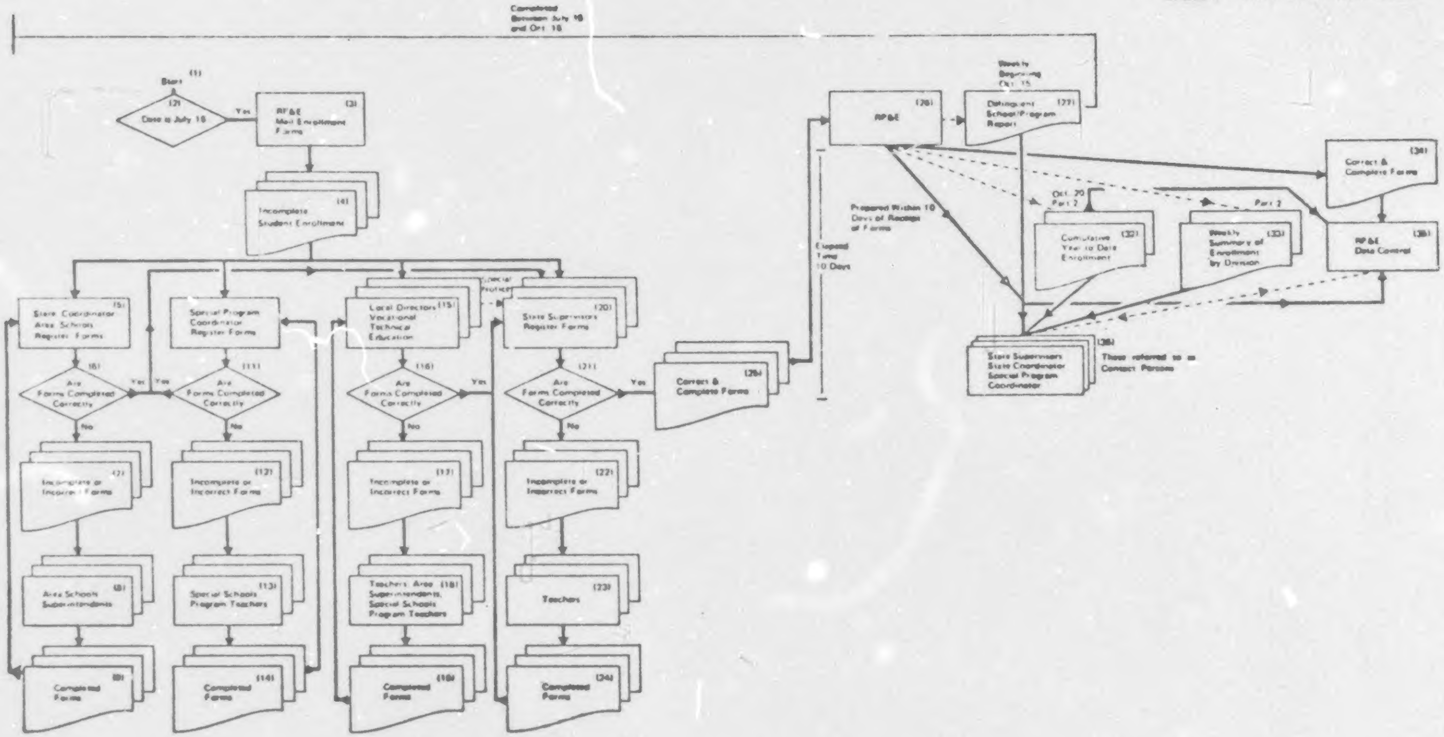
Completed Between July 16 and Oct 16
Start (1)
(2) Date is July 16
Yes
RF&E Mail Enrollment Forms (3)
Incomplete Student Enrollment (4)
State Coordinator Area Schools Register Forms (5)
(6) Are Forms Completed Correctly
Yes
No
Incomplete or Incorrect Forms (7)
Area Schools Superintendents (8)
Completed Forms (9)
Special Program Coordinator Register Forms
(11) Are Forms Completed Correctly
Yes
No
Incomplete or Incorrect Forms (12)
Special Schools Program Teachers (13)
Completed Forms (14)
Local Directors Vocational Technical Education (15)
(16) Are Forms Completed Correctly
Yes
No
Incomplete or Incorrect Forms (17)
Teachers Area Superintendents, Special Schools Program Teachers (18)
Completed Forms (19)
State Supervisors Register Forms (20)
(21) Are Forms Completed Correctly
Yes
No
Incomplete or Incorrect Forms (22)
Teachers (23)
Completed Forms (24)
Correct & Complete Forms (25)
Elapsed Time 10 Days
RF&E (26)
Weekly Beginning Oct. 15
Delinquent School/Program Report (27)
Prepared Within 10 Days of Receipt of Forms
Oct. 20 Part 2
Cumulative Year to Date Enrollment (32)
Part 2
Weekly Summary of Enrollment by Division (33)
Correct & Complete Forms (34)
RF&E Data Control (35)
State Supervisors State Coordinator Special Program Coordinator (36)
Those referred to as Contact Persons

STUDENT ACCOUNTING SYSTEM ENROLLMENT FLOW CHART

THE PENNSYLVANIA VOCATIONAL EDUCATION MANAGEMENT INFORMATION SYSTEM (VEMIS)

LOWERY E. MCHENRY

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OVERVIEW OF THE TOTAL MANAGEMENT INFORMATION SYSTEM

Historical Development

Prior to 1970, Pennsylvania--like most other states--struggled with the United States Office of Education annual report requirements by use of a manual data reporting system. State supervisors of the various fields of vocational education found it necessary to devote much of their time and effort to the many clerical tasks associated with data-gathering activities--form development, preparation of forms and instructions, distribution, clerical editing of retunred forms, mailing of non-respondent reminder letters, preparation and distribution of preliminary and final reports, and reaction to special report requests. These individual field reports were then merged into a comprehensive state report on all vocational programs. As a result, little time may have been available for state-wide management of vocational education program development and operation. Enrollment duplications within program areas and between program areas were extremely difficult, if not impossible, to determine. Moreover, data were gathered in aggregate form, and after the initial reports were prepared and the forms were filed, they were of only limited further use.

Special requests for program data not anticipated at the time the forms were developed either remained unanswered or created extreme burdens on state and local staff by necessitating additional data-gathering activity. Occasionally, special requests could be filled from data contained on the original forms, but this, too, usually required considerable activity--pulling thousands of forms from the files and compiling the data to conform to that specific request. This same scene was recreated many times throughout the year as greater demands were placed on accountability for vocational education programs, services, and activities.

With the enactment of the 1968 Amendments to the Vocational Education Act of 1963, the subsequent increase in report requirements, and the need for more meaningful state-wide program planning, it became apparent that vocational education was in a different ball game. We were playing in the big leagues. Congress, state legislatures, state boards, administrators, and the public were becoming cognizant of the hundreds of area vocational-technical schools quietly springing up throughout the nation. During the past ten years, more than 70 such schools were constructed in Pennsylvania alone. Enrollments had increased over 400 percent, and the number of different curriculum offerings had tripled as expenditures climbed toward the $200 million mark.

People started asking questions--provocative questions, important questions, critical questions. To what extent should emphasis be placed on labor market needs in planning new vocational programs? What standards, if any, should be imposed on existing and new programs? What really happens to graduates after they complete their training? What should be the criteria for admission to vocational programs? What is the capacity utilization of our present facilities? What is the profile of our pupils and teachers in terms of race, sex, geographic mobility, competence, age groupings, earnings, turnover, etc.?

For many of these questions we had no answers, and for others we had only poor guesses. If we were to free key personnel from being inundated by clerical tasks and to improve significantly our data collection and processing activities, it became apparent that we must turn to automation. In 1970 our State Director of Vocational Education, John W. Struck, approved the development of the Vocational Education Management Information System, or VEMIS as it is popularly known throughout Pennsylvania.

Organization and Design

Figure 1 describes the current organizational structure of VEMIS. The system is being developed under the general direction of the State Director. The Coordinator of VEMIS Activities in the Division of Administrative and Planning Services, Lowery E. McHenry, is directly responsible for the continuing operation of the system which functions through a cooperative arrangement with the Educational Systems Research Institute (ESRI) in Pittsburgh, Pennsylvania.

Max I. Eninger, President of ESRI, is responsible for the basic design and development of the system. He and his staff of analysts, programmers and technicians have provided invaluable technical assistance in the development and current operation of VEMIS.

Technical assistance relating to specific system application and policy is provided by five advisory committees representing the various educational levels and institutions incorporated in the system. The 27 members of the secondary advisory committee include state vocational education staff in the Bureau of Vocational Education; regional office chiefs; representatives from cooperating state agencies such as the Research Coordinating Unit, the Bureau of Statistics, the Management Information Services Division, and the Office of Planning in Higher Education; and several local administrators. The other committees are structured similarly. The Coordinator of VEMIS Activities is also sensitive to suggestions from the State Advisory Council, the State Board, the Commissioner, field consultants, and others.

The theoretical starting point of the VEMIS system is the Manpower Conversion Equation shown in Figure 2. VEMIS is not merely a system for collecting and reporting information about vocational education. It is a management information system relating to a body of goals and objectives for vocational education. The model shows undeveloped

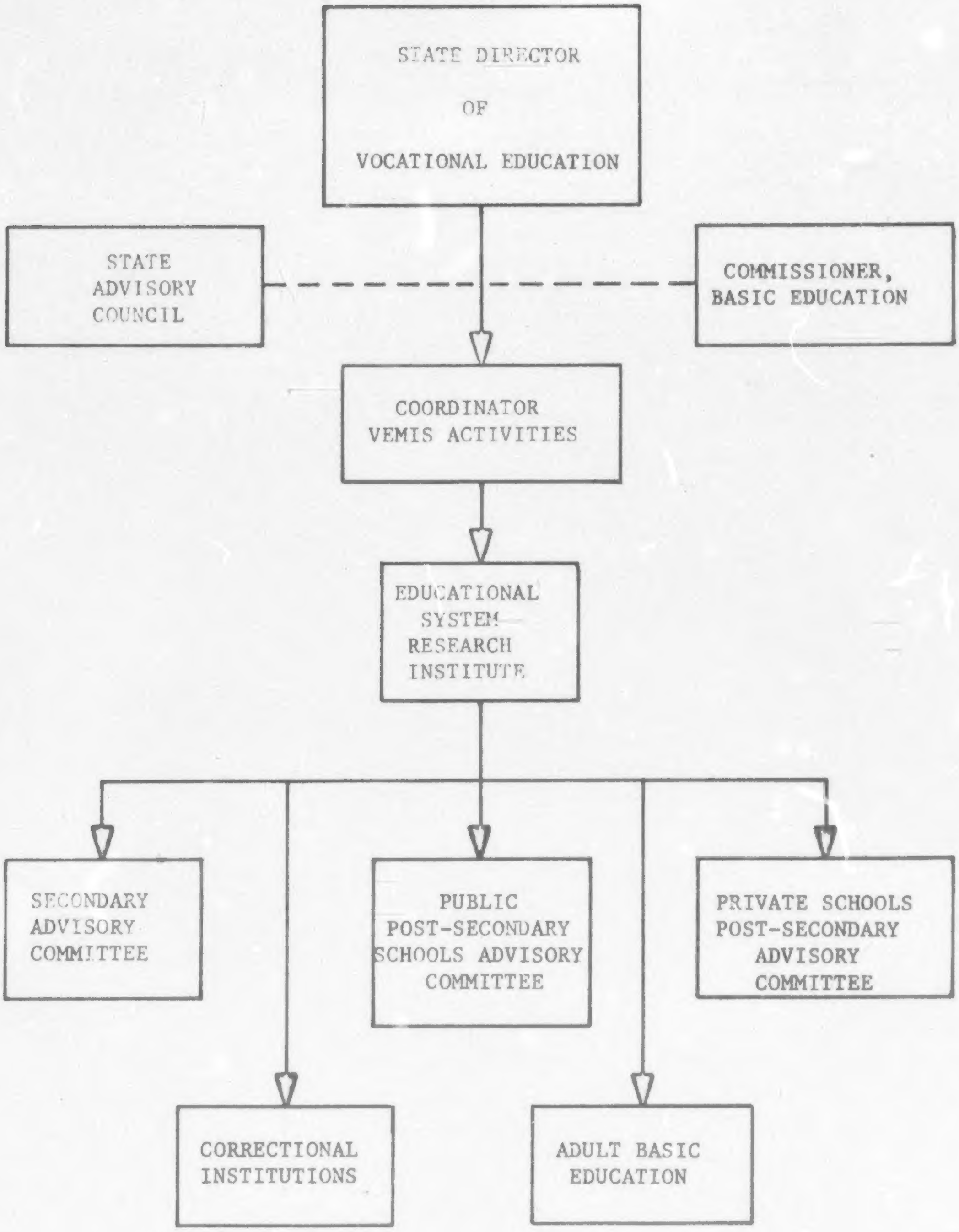
STATE DIRECTOR OF VOCATIONAL EDUCATION
STATE ADVISORY COUNCIL
COMMISSIONER, BASIC EDUCATION
COORDINATOR VEMIS ACTIVITIES
EDUCATIONAL SYSTEM RESEARCH INSTITUTE
SECONDARY ADVISORY COMMITTEE
PUBLIC POST-SECONDARY SCHOOLS ADVISORY COMMITTEE
PRIVATE SCHOOLS POST-SECONDARY ADVISORY COMMITTEE
CORRECTIONAL INSTITUTIONS
ADULT BASIC EDUCATION

Figure 1. Organizational Chart

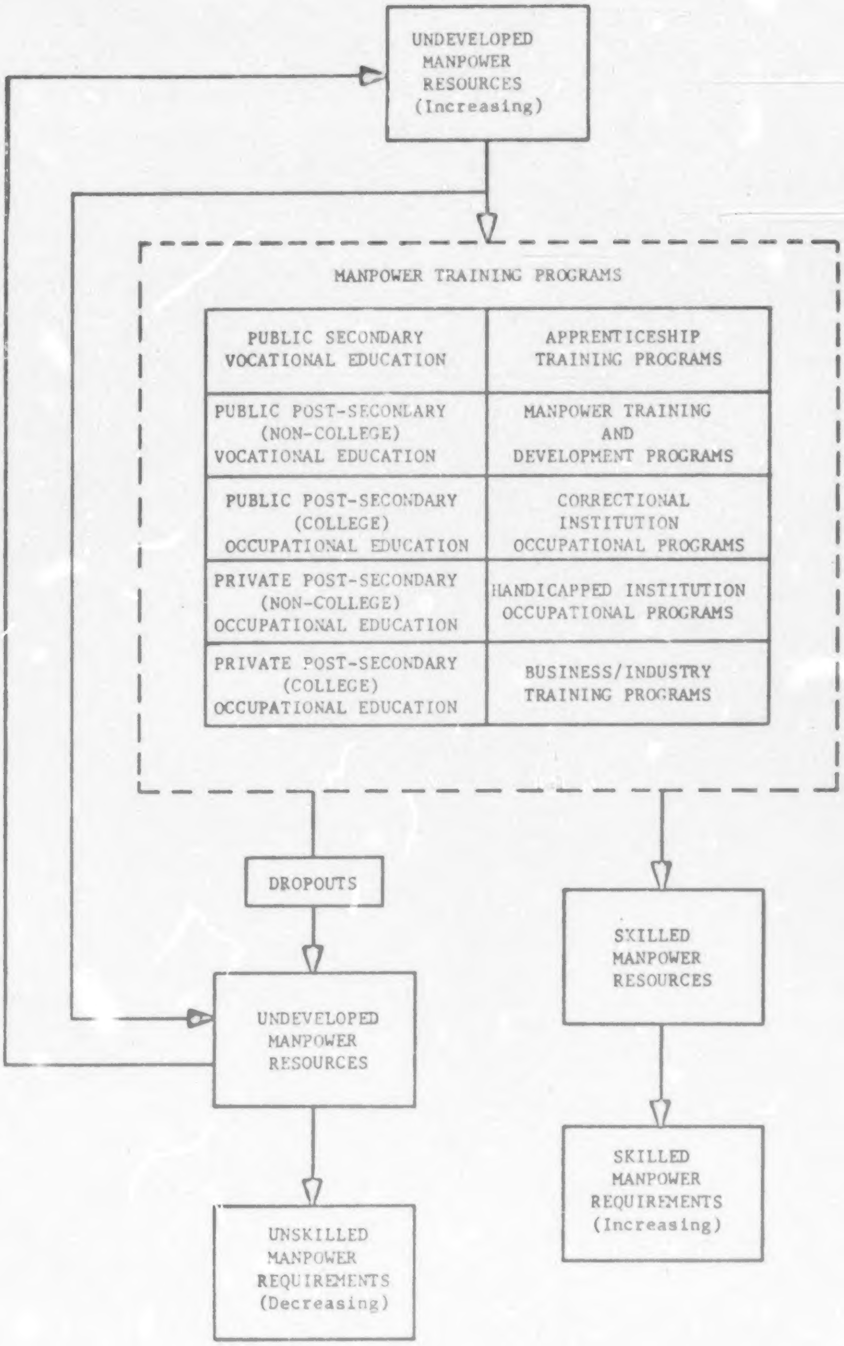
UNDEVELOPED MANPOWER RESOURCES (Increasing)
MANPOWER TRAINING PROGRAMS
PUBLIC SECONDARY VOCATIONAL EDUCATION
APPRENTICESHIP TRAINING PROGRAMS
PUBLIC POST-SECONDARY (NON-COLLEGE) VOCATIONAL EDUCATION
MANPOWER TRAINING AND DEVELOPMENT PROGRAMS
PUBLIC POST-SECONDARY (COLLEGE) OCCUPATIONAL EDUCATION
CORRECTIONAL INSTITUTION OCCUPATIONAL PROGRAMS
PRIVATE POST-SECONDARY (NON-COLLEGE) OCCUPATIONAL EDUCATION
HANDICAPPED INSTITUTION OCCUPATIONAL PROGRAMS
PRIVATE POST-SECONDARY (COLLEGE) OCCUPATIONAL EDUCATION
BUSINESS/INDUSTRY TRAINING PROGRAMS
DROPOUTS
UNDEVELOPED MANPOWER RESOURCES
SKILLED MANPOWER RESOURCES
UNSKILLED MANPOWER REQUIREMENTS (Decreasing)
SKILLED MANPOWER REQUIREMENTS (Increasing)

Figure 2. Manpower Conversion Model

manpower resources--people without marketable occupational skills--as input into three broad channels of manpower conversion or development. The model also illustrates that substantial numbers of our steadily increasing undeveloped manpower resources bypass the major sources of manpower development. Some remain essentially an undeveloped manpower resource for their working lives, holding down unskilled or low-level, semi-skilled jobs when employed. Others return to the start position and enter one of the major sources of manpower resources in a later period of their life. Often their occupational skill development comes through on-the-job training and/or business and industry training programs.

The model shows two kinds of output from these major areas of manpower resources: (1) skilled manpower resources, i.e., persons who have successfully completed their occupational education or training programs, and (2) undeveloped manpower resources, i.e., persons who have dropped out of their occupational education programs or completed their programs without mastering the necessary occupational knowledge and skills. Practically speaking, all such persons come out as they went in, namely, without a salable occupational skill. Hence, they are still an undeveloped manpower resource. Notice, however, that some recycle into one of the major manpower development sources.

On the far side of the equation, the labor market is represented by two broad categories, skilled manpower occupations and unskilled manpower occupations. For our purposes the many shades of grey between these two extremes are irrelevant. We know that the demand for skilled manpower is increasing, and that for unskilled manpower, it is decreasing. The model indicates that the output of skilled manpower is absorbed into the skilled occupations of the labor market and that the unskilled manpower naturally feeds into the unskilled occupations. As we have found, however, the real world does not necessarily conform to the ideal of the theoretical model. Sometimes, skilled persons end up in unskilled occupations.

Notice, too, that the model is an equation which states that the primary objective of the collective manpower development system is to recruit and convert undeveloped manpower resources into skilled manpower resources in sufficient kinds and numbers to meet the labor market requirements of the expanding Pennsylvania economy. In short, the objective is to balance supply and demand for skilled manpower. Think of what that means. The achievement of a balance implies that for every newly developed, skilled manpower resource there would be an available job opening, and that for every job opening for an occupationally skilled person, there would be an available and qualified person. A serious imbalance could mean an excessive supply of certain kinds of skilled manpower, an undersupply of certain kinds of skilled manpower, or a combination of both.

The theoretical model clearly relates the problem of manpower development to (1) the national policy of full employment, (2) the existing and projected manpower requirements of an expanding and technologically changing economy, (3) the existing and projected supply of undeveloped manpower resources, and (4) the public and private sources of skilled manpower development.

The basic challenge is to manage the collective system, within the constraints of our political institutions, so as to achieve a realistic balance between output (or supply) and labor market requirements (or demand) for skilled manpower. At the present time, there is no single governmental agency that is organized to accept the management challenge for the collective system. It is vocational education's role, then, to develop and implement the management information system for state and local manpower development through the following objectives:

1. Curriculum offerings growth. To increase year by year the range and diversity of secondary and postsecondary occupational curriculum offerings and, thereby, occupational learning opportunities available to all in need of occupational education, until the available opportunities adequately reflect both projected manpower requirements and the interests and abilities of the potential enrollees.

This objective is clearly implied by the manpower conversion model. If the institutions responsible for manpower development are to service the employer community and the target population who have undeveloped, underdeveloped, or obsolete occupational skills, then there must be growth in occupational curriculum offerings to keep in step with the manpower requirements of the labor market being served.

2. Curriculum enrollment growth. To increase the percentage of non-baccalaureate-degree-bound youth who are enrolled in occupational programs at the secondary and/or postsecondary levels, consistent with the manpower requirements of the labor market served by the institutions.

Youth who are employment-bound and without marketable occupational skills will have increasing difficulty in finding and holding jobs in labor markets in which the need for unskilled manpower is declining. It follows that schools should seek to increase their enrollments of those who are in need of occupational skills.

3. Occupational skill improvement. To increase year by year the percentage of occupational curriculum completers who have obtained the minimum entry-level occupational knowledges and skills to meet employer requirements.

Mere completion of an occupational curriculum does not necessarily mean that the completer has mastered the minimum requirements for entry into the occupation for which trained. Thousands of young men and women are passed on to the labor market each year who would not be recommended by their own instructors as qualified for entry into the field.

The educator-manager must be more concerned with the percentage of entry-level, unqualified completers that are the output of his occupational programs.

4. General skill improvement. To increase year by year the percentage of occupational program completers who meet reasonable minimum requirements with respect to basic general skills, particularly those skills related to learning ability.

The best insurance that can be given to those in our educational programs against future occupational obsolescence is the ability to continue their self-directed learning and study. Basic skills, such as reading, arithmetic and study skills, are just as essential in the long run as are occupational skills. Indeed, a follow-up survey of the class of 1968 secondary vocational students found that more than 62 percent felt that their work experience revealed that they were deficient in reading and arithmetic skills.

5. Holding power improvements. To increase year by year the percentage of students who complete the occupational curriculum of their choice.

Each curriculum dropout represents a potential loss of trained manpower and also an ineffective expenditure of training resources. One could make a long list of reasons why students do not complete their vocational programs. Behind many of these reasons, however, there are school-related, indirect contributing factors, such as inadequate exploratory experiences, insufficient occupational orientation, lack of vocational guidance, and acceptance without the prerequisites for successful completion.

6. Motivation for occupation studied. To increase year by year the percentage of employment-bound occupational program completers who are motivated to seek employment in the field for which trained or a related field.

Each year thousands of students who are in need of employment complete occupational programs with no intention of taking employment in the field for which trained. One VEMIS follow-up survey revealed that as high as 25 percent of the employment-bound, secondary vocational program completers did not want employment in their field of study. Such students are the dropouts who remained to complete the course. They leave the occupational education process as they came--an undeveloped manpower resource. Clearly, this represents a failure in manpower development for which educators must accept a major responsibility.

7. Improvement of in-field placement. To increase year by year the percentage of employment-bound, qualified occupational program completers who are placed in the occupation for which trained or a related occupation.

Placement into the field for which trained is the acid test of occupational education effectiveness. There is great room for improvement in terms of placement into the field studied. The principal reason cited by those who were not placed in their field was that they could not find jobs in their field. At the same time, an analysis of one labor market revealed that jobs were available but were filled by graduates from other fields. The graduates just were not making the right connections. Much of this problem is due to the fact that the great majority of secondary schools do not have an organized, single-person-directed job placement service.

8. Reduced cost per placement into field. To reduce year by year the total educational cost to develop and place an occupational curriculum graduate into the field for which trained.

Educational costs have increased so rapidly in the past several years that there is concern at all levels--local, state, and federal. The taxpayer has also shown his concern at the polls. The past year has seen more education bond issues voted down at the polls than ever before. School boards are under increased pressure to hold down their budgets despite rising costs. Opposition to rising educational costs demands that the educator-manager be concerned with showing his skills at cost control and cost reduction.

Current Capabilities and Future Plans

Figure 3 describes the present and long-term scope of VEMIS. The total system is composed of 12 integrated subsystems operating in ten different levels or institutions of vocational education:

1. The Program and Curriculum Approval System
2. The School District and School Basic Data System
3. The Student Basic Data System
4. The Personnel Basic Data System
5. The Curriculum Basic Data System
6. The Facilities Basic Data System
7. The Follow-Up Survey Data System
8. The Forecast System
9. The Special Survey Data System
10. The Expenditures Data System

VEMIS SYSTEMS AT RIGHT / SOURCES OR APPLICATION LEVELS BELOW	1 PROGRAM/CURRICULUM APPROVAL SYSTEM	2 DISTRICT/SCHOOL INSTITUTION SYSTEM	3 STUDENT BASIC DATA SYSTEM	4 PERSONNEL BASIC DATA SYSTEM	5 CURRICULUM BASIC DATA SYSTEM	6 FACILITY BASIC DATA SYSTEM	7 FOLLOW-UP SURVEY DATA SYSTEM	8 PROGRAM/CURRICULUM FORECAST SYSTEM	9 SPECIAL SURVEY DATA SYSTEM	10 EXPENDITURES BASIC DATA SYSTEM	11 GRANT PROJECTS DATA SYSTEM	12 ADMINISTRATIVE DATA SYSTEM
1. SECONDARY VOCATIONAL EDUCATION/PUBLIC										●	●	
2. POST-SECONDARY, NON-COLL. VOC. EDUCATION/PUBLIC										●	●	
3. POST-SECONDARY, COLLEGE OCC. EDUCATION/PUBLIC	▲				▲	▲			●	●	●	●
4. POST-SECONDARY, NON-COLL. OCC. EDUCATION/PRIVATE				●		●		●	●	▲	▲	▲
5. POST-SECONDARY, COLLEGE OCC. EDUCATION/PRIVATE	■			▲	■	■			●	■	■	■
6. APPRENTICESHIP OCCUP. EDUCATION TRAINING	■								●	■	■	■
7. MANPOWER TRAINING AND DEVELOPMENT PROGRAMS	▲	▲	▲	▲	■	■	▲	■	●	■	■	■
8 CORRECTIONAL INSTITUTION OCCUPATIONAL PROGRAMS	●	●	●	●	▲	▲	●	■	●	■	■	■
9. HANDICAPPED INSTITUTION OCCUPATIONAL PROGRAMS	●	●	●	●	▲	▲	●	■	●	■	●	■
10. BUSINESS/INDUSTRY TRAINING PROGRAMS	■	▲	▲	▲	■	■	▲	■	●	■	■	■

☐ OPERATING

● PROJECTED 1973-74

▲ PROJECTED LONG-TERM

■ NOT APPLICABLE

Figure 3. Present and Long-Term Scope of VEMIS System

11. The Federal Projects Data System

12. The Administrative Data System

Nine of the subsystems require direct involvement of the local educational agency. The Federal Projects Data System and the Administrative Data System are internal systems not requiring forms distribution, and the Follow-Up Survey Data System is conducted directly with the graduate in the field.

By the end of the current school year, VEMIS will be fully operative in all secondary schools and in postsecondary, public, noncollege institutions. The major subsystems are in operation in postsecondary public colleges and private proprietary colleges. They include the community colleges, branch campuses and proprietary colleges approved to offer the associate degree. It should be noted that all subsystems are not applicable to all institutions shown on the figure. The manpower conversion model under which the system functions requires only that the district/school, student, personnel, and follow-up subsystems be operative. It is estimated that VEMIS will include about 95 percent of all known vocational or occupational education programs in the state by the end of the current year.

Overview of the Subsystems of Interest

Now let us look at the Student Basic Data System and the Follow-Up Survey Data System in greater detail. Inasmuch as all subsystems are automated, interrelated and integrated, it will be necessary on occasion to touch on the others as well.

Organization

Not all the institutions and levels of education incorporated in the system are under the direct administrative control of the state director. Their subsystem operation is within the realm of his basic responsibility, however, to the extent that (1) they share in the use of funds under his supervision, (2) the Bureau is tied to them for management services, or (3) they are an important source of manpower conversion. As indicated earlier, the student and follow-up subsystems are under the direct supervision of the Coordinator of VEMIS Activities, with the advisory committees providing direction on aspects relating to the actual operation of vocational programs.

Objectives

The Student Basic Data System provides the Bureau of Vocational Education with aggregate data on vocational student enrollments, transfers and terminations plus such other information as is necessary to classify the aggregate data. The requirements of data organization make it necessary to collect student information on an individual student basis to permit computer aggregation of data in the many combinations required of the Bureau. The broadly stated purpose of the subsystem is to provide the basic student information required for state-level vocational education management, i.e., program planning, budgeting, reimbursing, reporting, evaluating, and other such basic management functions.

The major objective of the annual graduate follow-up survey is to evaluate the effectiveness of secondary, postsecondary and adult preparatory vocational curricula as a source of qualified, entry-level skilled manpower for the Pennsylvania economy. The Bureau of Vocational Education is concerned with identifying major weaknesses in vocational education as revealed through the post-school experiences reported by the graduates. The ultimate objective is to improve the effectiveness of vocational education as a major supplier of skilled manpower in accordance with the manpower conversion model discussed earlier.

The two subsystems in question, indeed, the entire system is funded through the state director's office under the provisions of Public Law 90-576--the 1968 Amendments, Part B, Ancillary. The estimated annual operating cost of the total system is about $250,000. This is estimated because we are still developing various parts of the subsystems, and it is not always possible to break out the operational costs from the development costs. It is equally impossible to break out the true costs of the two subsystems in question because all 12 subsystems have developed concurrently under one agreement with ESRI. The best guess of the annual operational cost of the two subsystems is approximately $100,000. At first glance, this seems considerably high, but when one considers that we were spending more than that amount to gather data manually, the costs are viewed in better perspective. It is estimated that the combined number of cases monitored by the two subsystems in question, for all type of institutions, will approach 800,000 during this year--a cost of 11 cents per case. In addition, the subsystems collect much more data than in the past and generate ten times as many needed reports and directories. Over 30 standardized products, the average start-up cost for a typical machine shop curriculum, including equipment, salaries, maintenance, supplies, etc., may be over $200,000. The system pays for itself if it supports the decision to place just two such curricula in the right institution or labor market.

General Description

The subsystems were developed through consultation with the Divisions of Program Development, Operations, and Planning in the Bureau of Vocational Education, with continued operation, evaluation and improvement accomplished through monthly meetings of the various advisory committees. Although the subsystems have been fully operational since the 1971-72 school year, they have undergone continual change to improve form preparation, data collection and reporting procedures.

The student subsystem enrolls over 350,000 students in over 600 high schools, 84 area vocational-technical schools, 14 community colleges, 19 branch campuses, 38 private proprietary schools approved to grant the associate degree, six special education schools, and several development centers for youthful offenders. This year we are adding over 600 private business colleges and trade schools, eight correctional institutions, and over 300 schools offering adult basic education, general adult non-credit education, and adult general education diploma programs.

On the secondary level, Pennsylvania requires compliance with specific standards prior to curriculum approval to operate and be eligible for state reimbursement. Reporting of students is restricted to these approved curricula. Enrollments are reportable by full-term curricula meeting at least the minimum requirements for any other major field of study over a two- or three-year period. We do not report by subject or class, thereby reducing the possibility of duplicate enrollments. A large combination of enrollment in two different fields, however, is permitted in the case of Useful Home Economics and any one of the other vocational fields. This is allowed because of the one-period-per-day minimum for curricula in the home economics field. Although such duplication is permitted, the computer can readily determine the duplicates through program edit routines, and unduplicated report totals are possible.

Relationship of the Subsystems to Decision-Makers

Determination of Information Needs

Information needs are determined through the monthly advisory committee meetings, feedback from system users and future plans of the Bureau. Figure 4 displays the current data sources and users of system information. The Coordinator of VEMIS Activities in the Division of Administrative and Planning Services is a clearinghouse for information needs of decision-makers. Many reports and directories have been standardized through repeated requests for similar information. Examples are the annual federal report series 3100, various State Bureau of Statistics annual report requests, state plan requirements, report requests established by the VEMIS Advisory Committees and State Advisory Council requests. The total system currently produces almost 100 different products containing as many as a dozen tables, some of which are 20 to 30 pages in length. One such product, the Secondary Program Enrollment Director, lists all curricula in the state by region, by school district, by school, by curriculum, by grade, by race, and by sex. The directory is almost three inches thick.

Many reports are simply input/output products requiring limited computer manipulation of data. Others are considerably more complex and require merging of several files and stringing variables to create the needed information.

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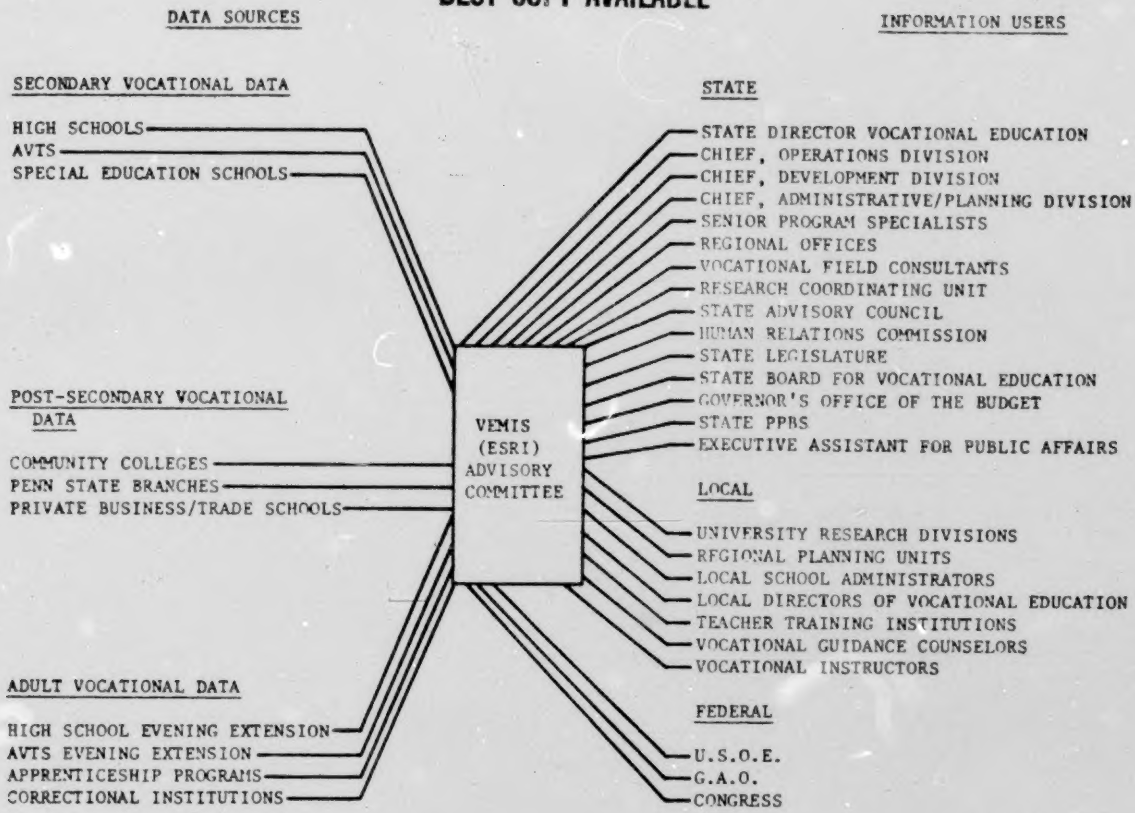
DATA SOURCES
SECONDARY VOCATIONAL DATA
HIGH SCHOOLS
AVTS
SPECIAL EDUCATION SCHOOLS
POST-SECONDARY VOCATIONAL DATA
COMMUNITY COLLEGES
PENN STATE BRANCHES
PRIVATE BUSINESS/TRADE SCHOOLS
ADULT VOCATIONAL DATA
HIGH SCHOOL EVENING EXTENSION
AVTS EVENING EXTENSION
APPRENTICESHIP PROGRAMS
CORRECTIONAL INSTITUTIONS
VEMIS (ESRI) ADVISORY COMMITTEE
INFORMATION USERS
STATE
STATE DIRECTOR VOCATIONAL EDUCATION
CHIEF, OPERATIONS DIVISION
CHIEF, DEVELOPMENT DIVISION
CHIEF, ADMINISTRATIVE/PLANNING DIVISION
SENIOR PROGRAM SPECIALISTS
REGIONAL OFFICES
VOCATIONAL FIELD CONSULTANTS
RESEARCH COORDINATING UNIT
STATE ADVISORY COUNCIL
HUMAN RELATIONS COMMISSION
STATE LEGISLATURE
STATE BOARD FOR VOCATIONAL EDUCATION
GOVERNOR'S OFFICE OF THE BUDGET
STATE PPBS
EXECUTIVE ASSISTANT FOR PUBLIC AFFAIRS
LOCAL
UNIVERSITY RESEARCH DIVISIONS
REGIONAL PLANNING UNITS
LOCAL SCHOOL ADMINISTRATORS
LOCAL DIRECTORS OF VOCATIONAL EDUCATION
TEACHER TRAINING INSTITUTIONS
VOCATIONAL GUIDANCE COUNSELORS
VOCATIONAL INSTRUCTORS
FEDERAL
U.S.O.E.
G.A.O.
CONGRESS

Figure 4. System Sources and Users

Utilization of Information

It is impossible to list all uses to which system-generated information has been put. Most of the users in this illustration have applied standard and special request outputs to management decisions. For example:

1. The RCU uses follow-up information as input to the supply-demand model.

2. The State Human Relations Commission is using the information to prod local educational agencies into providing greater service to minority groups.

3. The Governor's Office of the Budget is conducting a review of our reimbursement procedures based on information provided by the system. It is hoped that the study will result in state legislation to increase reimbursements going to the school districts.

4. Our Executive Assistant for Public Affairs in Washington, D. C., is using system information to help influence favorable legislation for vocational education.

5. Newspaper reports and periodical articles have helped carry meaningful information to the public and to local school boards.

6. Our Senior Program Specialists use system-generated information to assist in determining new program approvals.

7. Our Operations Division Chief and his field consultants use system products to assist in monitoring on-going programs.

8. The State Advisory Council prepares annual evaluation reports based on system-generated information.

9. The system provides information (a) in support of annual legislative budget reviews and hearings and (b) for input to the Pennsylvania Program, Planning, and Budgeting System to support state budget proposals.

This list is not exhaustive. New avenues for user management decisions are arising continuously.

Operational Description of the Subsystems

Input

Figure 5 (Student) illustrates the flow of the Student Basic Data System. Only the secondary level is described here, but the same procedures apply to all other levels. All forms used are machine scannable

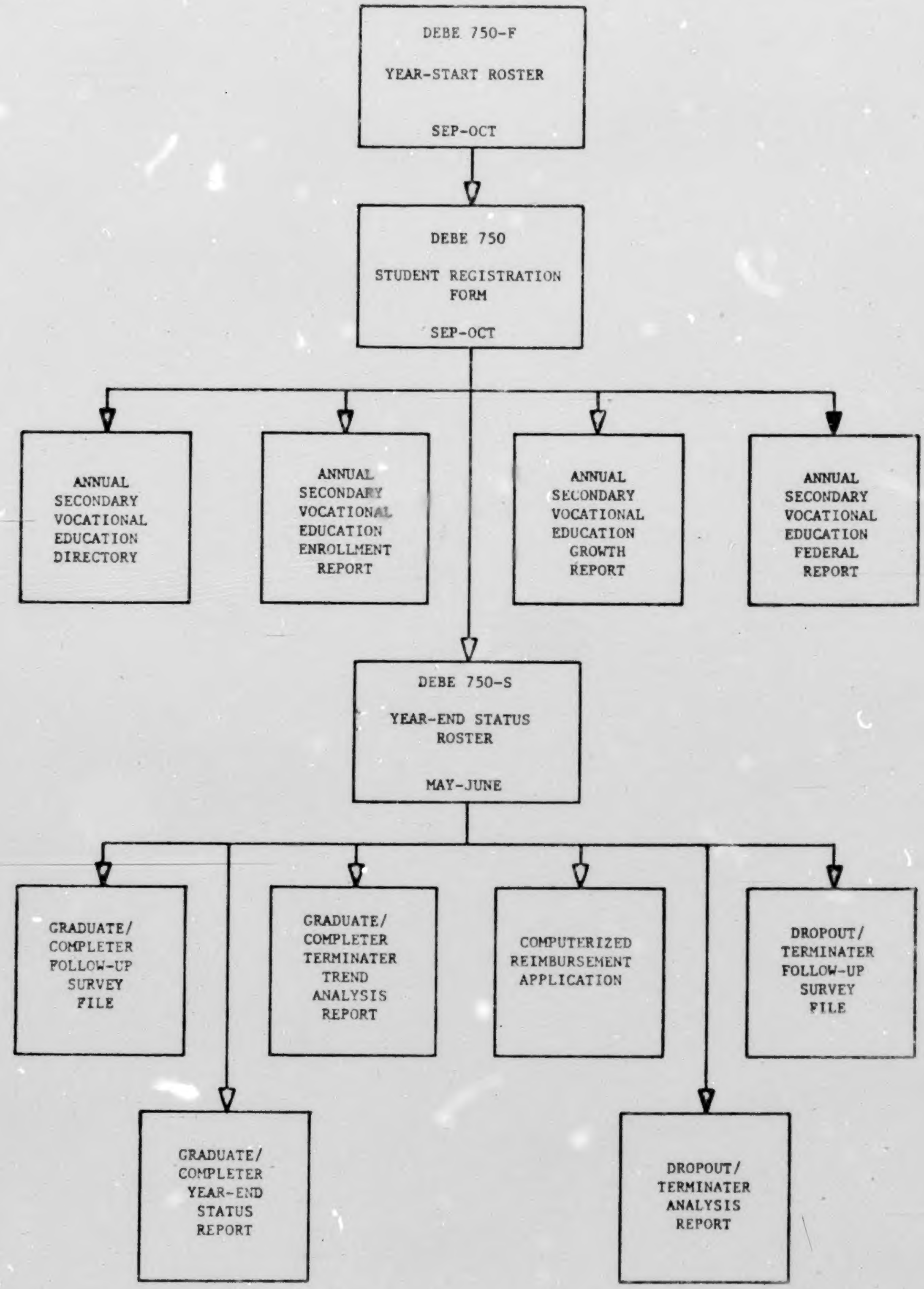
DEBE 750-F
YEAR-START ROSTER
SEP-OCT
DEBE 750
STUDENT REGISTRATION FORM
SEP-OCT
ANNUAL SECONDARY VOCATIONAL EDUCATION DIRECTORY
ANNUAL SECONDARY VOCATIONAL EDUCATION ENROLLMENT REPORT
ANNUAL SECONDARY VOCATIONAL EDUCATION GROWTH REPORT
ANNUAL SECONDARY VOCATIONAL EDUCATION FEDERAL REPORT
DEBE 750-S
YEAR-END STATUS ROSTER
MAY-JUNE
GRADUATE/ COMPLETER FOLLOW-UP SURVEY FILE
GRADUATE/ COMPLETER TERMINATER TREND ANALYSIS REPORT
COMPUTERIZED REIMBURSEMENT APPLICATION
DROPOUT/ TERMINATER FOLLOW-UP SURVEY FILE
GRADUATE/ COMPLETER YEAR-END STATUS REPORT
DROPOUT/ TERMINATER ANALYSIS REPORT

Figure 5. VEMIS Student Basic Data System

forms which are fed directly into the system. The flow is viewed as a continuing cycle. At the beginning of each school year, a computer-printed year-start roster is sent to each school in the system. A different roster is generated for each curriculum approved to operate at that school. The roster contains the names of all students retained in the system from the preceding year, i.e., all students not terminated or transferred on the year-end status roster completed at the end of last year. School personnel verify or update the roster as required, add any new students entering the system that year and supervise the completion of a student registration form for all new enrollees.

The individual student registration form provides the possibility of processing, aggregating and reporting data in thousands of combinations not possible under the manual system. Reports are generated by curriculum, by school, by school district, by county, by legislative unit, by labor market, by SMSA, by intermediate unit, by race, by sex, etc. It also provides for chaining or stringing variables to produce special reports such as, "all the male blacks on cooperative education status who were not hired in their field trained in a given locality of the state."

The year-end status roster is a computer-printed form containing a list of all students enrolled for that year in that curriculum. School personnel complete the form by (1) verifying data added for new enrollees generated from the student registrations for that year, (2) marking all students who terminated the curriculum, (3) marking the reason for termination or transfer, (4) marking all students who were on cooperative education status during the year, and (5) marking the total days membership belonged for each student. The last item is used to calculate the state reimbursements due the school district for that year. At the bottom of Figure 5 you will see some of the standard products generated by the subsystem.

Figure 6 illustrates the Follow-up Survey Data System which is operative for all students in all institutions described in the Student Basic Data System. Follow-up surveys are conducted on the secondary, postsecondary and adult preparatory levels. Although this illustration describes only the secondary level, the basic procedures are the same for all levels. This subsystem, the first to be initiated, has been in operation since 1968.

Output

As indicated earlier, the year-end status roster generates the mailing address file for all completors and dropouts. The annual surveys produce various state management reports as well as the annual federal reports. Comprehensive analyses of the reports have created considerable activity for further research and program improvement on the state and local levels. For example, federal funds have been released to develop a placement services manual for use by local educational agencies. Many project proposals have been generated and

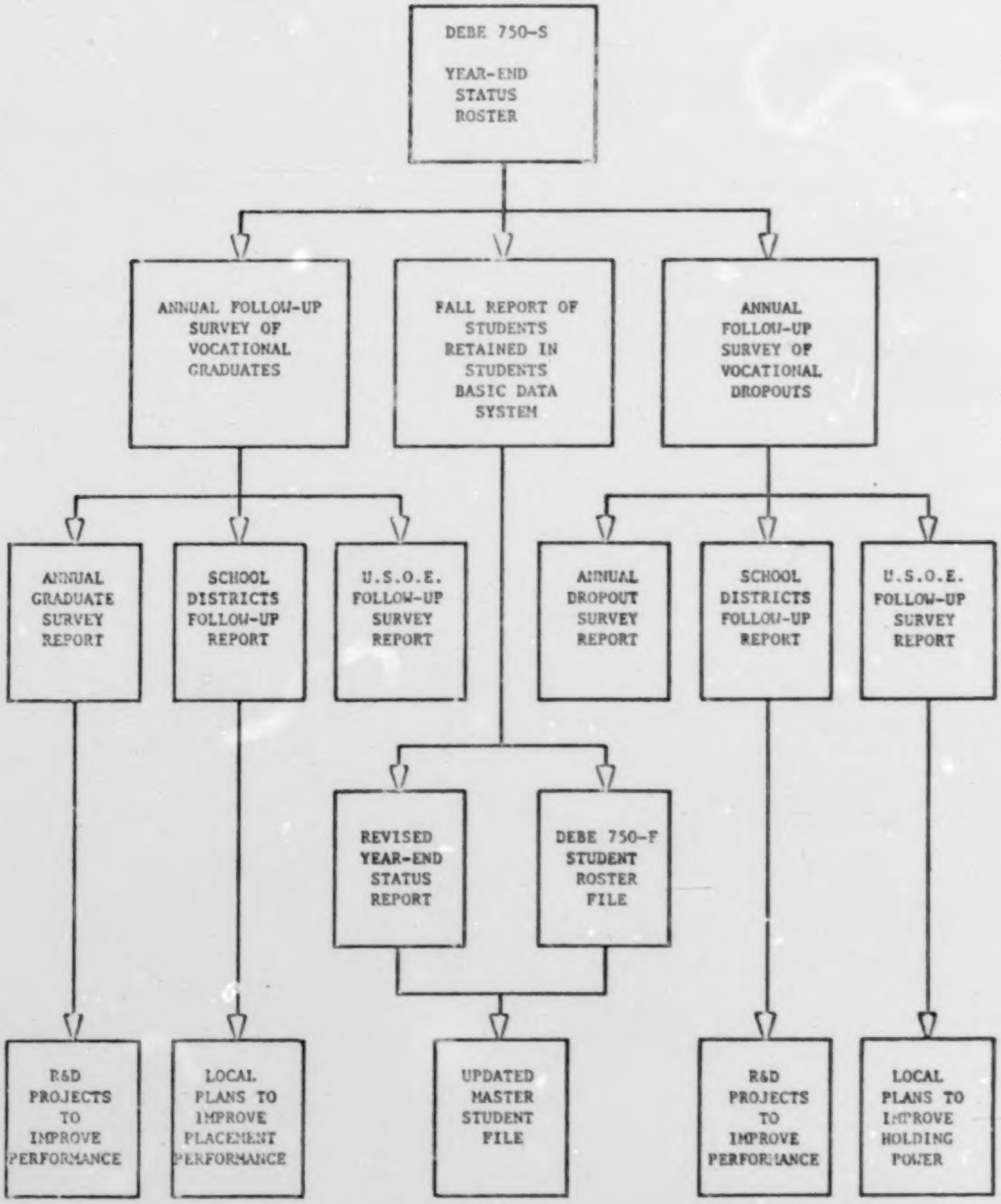
DEBE 750-S
YEAR-END STATUS ROSTER
ANNUAL FOLLOW-UP SURVEY OF VOCATIONAL GRADUATES
FALL REPORT OF STUDENTS RETAINED IN STUDENTS BASIC DATA SYSTEM
ANNUAL FOLLOW-UP SURVEY OF VOCATIONAL DROPOUTS
ANNUAL GRADUATE SURVEY REPORT
SCHOOL DISTRICTS FOLLOW-UP REPORT
U.S.O.E. FOLLOW-UP SURVEY REPORT
ANNUAL DROPOUT SURVEY REPORT
SCHOOL DISTRICTS FOLLOW-UP REPORT
U.S.O.E. FOLLOW-UP SURVEY REPORT
REVISED YEAR-END STATUS REPORT
DEBE 750-F STUDENT ROSTER FILE
R&D PROJECTS TO IMPROVE PERFORMANCE
LOCAL PLANS TO IMPROVE PLACEMENT PERFORMANCE
UPDATED MASTER STUDENT FILE
R&D PROJECTS TO IMPROVE PERFORMANCE
LOCAL PLANS TO IMPROVE HOLDING POWER

Figure 6. VEMIS Follow-Up Survey Data System

funded for guidance and placement services personnel in the area vocational-technical schools and in the high schools throughout the state. A special study on placement services was conducted through the Special Survey Subsystem to provide more specific data on placement service activities, or the lack of them, in the local school districts.

Individual school reports were issued to the local educational agencies to provide feedback on program completors and to stimulate program improvement where applicable. Highlight reports on state-wide results were distributed for comparative analyses. In addition, printouts of all graduates found to be unemployed and looking for work at the time of the survey were returned to the schools for further follow-up and employment assistance.

This year we are conducting surveys of all program dropouts to help determine program and employment problems encountered by this target group. Also, a four-year follow-up of the 1969 graduates is being conducted to analyze geographic mobility and occupational vertical and horizontal mobility. We want to find out if graduates initially hired out of their field of study eventually gravitate back to their field or really represent a loss in expenditures, instructional time, and learning experiences. In summary, we are conducting seven different surveys this year.

In 1970 Pennsylvania was the first state to report somewhat startling results in the annual federal report relative to graduate placement. Several other states have since joined us in "telling it like it is."

Future plans include the development of a Computer Assisted Placement Services Program (CAPS). The follow-up questionnaires have been revised to include employer name, address, and other information in a scannable form on the reverse side of the form. The returns will establish a data bank of thousands of known employers of vocational graduates. All employers will then be surveyed to determine future placement opportunities for our graduates.

Most non-standard report requirements and special data requests can be satisfied by reference to standardized reports or a combination thereof. Invariably, however, requests are received which require information not consistent with formats anticipated by the system operators. When this occurs, special requests must be programmed with turn-around time from one day to several days depending on the magnitude and complexity of the information request and other demands being placed on the system operators at that time.

General Discussion and Critique of the Subsystems

Generally the system is functioning well beyond our initial expectations. I would not be honest with you, however, were I to imply that VEMIS functions without problem areas. Everything that could possibly go wrong has occurred at one time or another throughout the years of system development, but the system has emerged stronger from each such encounter.

Two major problems do exist and persist, and they may continue to plague us indefinitely. Technical problems, although they are extremely frustrating, can be resolved by burning the midnight oil until a solution is found. People problems, however, cannot. One of our unending problems is local administrative procrastination relative to forms completion and submission. Ninety percent of our forms are returned within the suggested time frame; the other ten percent is like pulling teeth. As a result, we are often faced with a trade off situation of producing reports that are inaccurate and incomplete or holding production of the reports pending more complete returns.

The other major problem we see is the instability of federal financial support of vocational education and the time frame cf federal reporting requirements. Major decisions regarding future plans for vocational education and the information systems under which they function cannot be made until some stability is realized on the federal legislative level and until reporting requirements establish a time-frame which is realistic for the states. Let us hope that the required stability is soon realized.

Future plans call for the use of a data base management software package to give us capability to update files randomly. Also, our state computer facility has acquired the Mark IV package which now gives us the ability to access data in the files in a much more timely manner. We hope to have a terminal in the Division of Administrative and Planning Services office tied directly to the system files. This cannot be done, however, until telecommunications equipment is installed at the computer site.

VEMIS has stimulated immeasurable activity in vocational education in Pennsylvania. We look forward to final development of the system to satisfy the full potential of the manpower conversion model under which the system functions so that state and local administrators can exercise their true roles as managers of manpower conversion and thus improve the economic environment of Pennsylvania.

VERS -
THE STUDENT ACCOUNTING COMPONENT OF VEMIS-V

PATHE S. VIVEKANANTHAN
AND
J. DALE OLIVER

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OVERVIEW OF THE TOTAL MANAGEMENT INFORMATION SYSTEM

Historical Development

The reporting requirements and funding patterns of the federal vocational education legislation during the 1960's furnished a major impetus for the development of Management Information Systems (MIS) for vocational education. Such was the case in Virginia when, in 1971, a major research effort, known as the Vocational Education Evaluation Project (VEEP), was initiated at Virginia Polytechnic Institute and State University (VPI and SU). The primary objective of this project is to develop a Vocational Education Management Information System for Virginia (VEMIS-V). The direct costs for VEEP are being funded on a 90 percent reimbursement basis by the Division of Vocational Education, State Department of Education. These funds are from Part C of the Vocational Education Amendments of 1968. The remaining 10 percent of direct costs and all indirect costs are funded by the Research Division, VPI and SU.

Organization and Design

Developmental work on VEMIS-V has been a closely coordinated effort between the VEEP staff and personnel in the State Department of Education (SDE). The project staff members take the lead in developing the components of the system and assist in field-testing them. When the components are implemented, they become a part of the SDE and are under the supervision of the Coordinator of Vocational Education Research and Statistical Information (Figure 1). This staff member works jointly with the Director of Vocational Education and the Director of Educational Research and Statistics, SDE. Administratively, this individual comes under the Director of Vocational Education. The coordinator maintains liaison with the supervisors of the vocational services and has a staff to assist in operating the system. All data processing is done in the Division of Educational Research and Statistics, SDE.

Current Capabilities and Future Plans

VEMIS-V is envisioned to include subsystems to furnish information on:

1. student enrollment by programs and program information;

2. follow-up of former students, giving their status and attitudes toward programs;

3. personnel resources available;

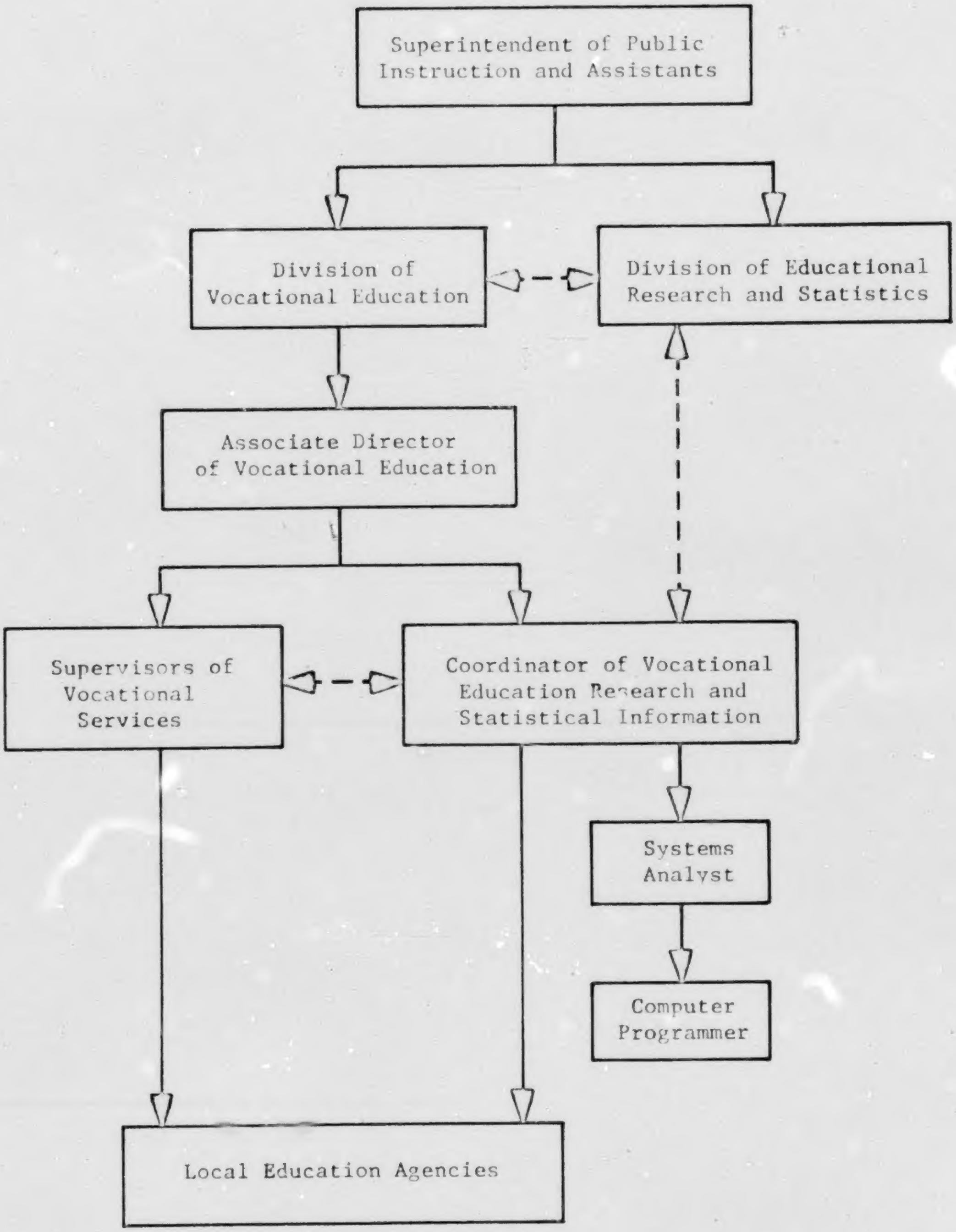
Superintendent of Public Instruction and Assistants
Division of Vocational Education
Division of Educational Research and Statistics
Associate Director of Vocational Education
Supervisors of Vocational Services
Coordinator of Vocational Education Research and Statistical Information
Systems Analyst
Computer Programmer
Local Education Agencies

Figure 1. Organizational Chart for VEMIS-V

4. facilities and equipment available and present and potential use of these resources;

5. financial resources available and the cost of operating programs; and

6. manpower demand and student needs and interests.

This information will be primarily useful to decision-makers at the state level. However, much of the information will also be useful in local decision-making. The above list of components is not intended to be exhaustive. Other subsystems will be added as the need arises.

Thus far, the enrollment and follow-up subsystems of VEMIS-V have been fully developed and have been in operation statewide since the 1972-73 school year. These two subsystems make up a student accounting system which is called the Vocational Education Reporting System (VERS). This system provides for collecting pertinent information on current students, former students, and programs. VERS will be fully described later in this paper.

Work is underway toward the development of the subsystem dealing with facilities and equipment and financial resources. The personnel resources subsystem will be developed in cooperation with the Division of Educational Research and Statistics, SDE, which is now using an optical scanning form to collect data on all teachers in the state. Assistance will be sought from the Virginia Employment Commission and other agencies in developing procedures to generate manpower need projections. Future plans are to continue using VERS and to complete the development of the other components discussed above.

Overview of the Vocational Education Reporting System

Objectives

The objectives of VERS, the student accounting portion of VEMIS-V, are as follows:

1. To provide a means for collecting uniform and accurate data about vocational programs and about current and former students of these programs.

2. To streamline the data-gathering procedures and reduce the amount of work required by teachers.

3. To reduce the time and effort required by state supervisory personnel in processing and handling data.

4. To make the enrollment and follow-up data more readily accessible to decision-makers in the format desired.

These objectives are being achieved by designing procedures that could be used in all vocational services, by using students to supply a major portion of the data on optical scanning forms, and by processing the data using an optical scanning machine and a computer. The system has been field-tested for its feasibility, and several revisions were made prior to statewide implementation.

Organization

The information generated by VERS is available to those agencies in the state which have a need for it. Primary users are the Director of Vocational Education and his assistants, the supervisors of the vocational services, and the State Advisory Council on Vocational Education. Data by school divisions are useful to superintendents and local directors. Data on the future plans of students should be useful to the Department of Community Colleges and the State Council of Higher Education.

As noted previously, the operation of VEMIS-V, of which VERS is a component, is under the supervision of the Coordinator of Vocational Education Research and Statistical Information, SDE. The State Coordinator is housed in the Division of Educational Research and Statistics, SDE, for convenience since this is where the data are received, processed, and disseminated. This person reports to the Director of Vocational Education, SDE, in carrying out the various responsibilities. The staff of the VEEP project at Virginia Polytechnic Institute and State University are responsible for making revisions in the system as needed.

The Division of Vocational Education, SDE, funds all costs of operating VERS except the cost of data processing equipment. The equipment costs are borne by the Division of Educational Research and Statistics, SDE. The total cost of operating the system during the 1972-73 school year was $73,626 (Figure 2).

General Description

After VEEP was funded in 1971, the State Vocational Education Staff gave top priority to the development of VERS, which consisted of the enrollment and follow-up subsystems. A number of other reporting systems were reviewed and found to be either too expensive to operate or in need of too much alteration to be feasible. Hence, the development of a new system was undertaken.

The system was conceptualized and developed with the active involvement of the supervisors from each vocational service. After the enrollment subsystem was completed, the supervisors assisted in selecting schools and arranging for a field test. The field test was conducted in 16 schools involving about 11,000 students. Several problems in form layout and operational procedures became evident as a result of

Teachers guides	$ 1,000
Purchase of VEEP-1 Forms (375,000)	4,550
Salaries and Travel (4 staff and Kelly help)	47,444
Consulting assistance VEEP project staff	2,000
Mailing	650
Printing	866
Equipment - office	1,078
Supplies	1,240
Miscellaneous expenses	1,500
Key punch personnel	2,591
Computer (testing, editing, tapes, etc.)	9,182
Op. Scan 100 (purchase share and maintenance)	1,525
TOTAL	$73,626

Figure 2. Cost Estimate for Operation of VERS*
During 1972-73 School Year

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*Cost of collecting and processing data for about 230,000 secondary students, 68,000 adults, and following up 1,982 students.

the field test. Revisions were made to correct these problems. The follow-up component was field-tested in the same 16 schools. It was found that 1,982 students from the schools were eligible to be followed up. A follow-up form with a business reply envelope was mailed to the former students. After two reminders, 1,338, or about 69 percent, of the students completed and returned the form. Some revisions were made in the follow-up instrument after the responses were analyzed.

The estimated cost of developing VERS was about $100,000. This can be broken down into about $70,000 for the VEEP work and $30,000 for the State Coordinator and his staff.

VERS is capable of collecting and handling data on a large number of students. In 1972-73 enrollment forms were processed for approximately 230,000 students. The system provided preliminary enrollment data in January, 1973, which were useful to the State Director and his staff in developing the State Plan.

VERS consists of five basic steps. The first step deals with the collection of information about enrollees and vocational education programs. Student characteristics, addresses, and program information are obtained from the students and instructors, using the optical scanning form, Virginia Vocational Education Student Enrollment Form (Appendix A). The major portion of this information is provided by the individual student under the direction of the teacher. The forms are completed on or about September 30, with forms for each new student who enrolls after that date being completed and submitted later. An optical scanning device is used in processing the forms and storing the information on a computer tape.

In step two, the data processing routines draw from the computer tape the information needed to develop lists of students with their names and identification numbers. A list is developed for each vocational course in each school in the state.

The third step begins with the returning of the student lists to teachers in May. The lists are in the form of computer printouts and have been designated as the Virginia Vocational Education Program Termination or Completion Form (Appendix B). The teachers examine the lists and note changes in the status of the students. Those who have withdrawn from the program or who have completed the program requirements are so indicated on the form. The computer tape is updated by adding this information to the students' records. Thus, at the end of the school year, the computer tape contains up-to-date information on all students who were enrolled in each program during the year.

Step four involves a follow-up of students who completed the program requirements or who terminated their training but have a marketable skill. These students are identified from information provided by the teachers on VEEP-2. The follow-up questionnaires (Virginia Vocational Education Follow-Up Form, VEEP-3, Appendix C) are mailed directly to the students at the address they gave on the VEEP-1 Enrollment Form.

Step five is an analysis of the follow-up survey. The completed follow-up questionnaires are keypunched on data cards and the necessary information compiled. Follow-up data, along with the other information on the computer tape, are analyzed and compiled in the format desired by those who will use the data.

Also included in VERS are enrollment data related to adult vocational programs. Summary enrollment information about students in adult vocational programs is collected from the teacher upon completion of each course using the Virginia Vocational Education Adult Enrollment Form (Appendix D). Data have been collected for about 68,000 adults.

In order to operate VERS, a teacher's guide has been prepared. This guide contains the forms, instructions for the teacher, and instructions to give to the students.

Plans are to continue using the system with revisions as needed. The operation of VERS is well underway for 1973-74. The teacher's guide and the forms have been revised to facilitate their use. In the revision, a new numbering system was devised for the VERS forms. The first digit in the number refers to the type of form, and the second digit indicates revisions in the form. The new numbers are as follows: VERS 1.1--Virginia Vocational Education Student Enrollment Form; VERS 2.1--Virginia Vocational Education Adult Enrollment Form; VERS 3.1--Virginia Vocational Education Program Termination or Completion Form; and VERS 4.1--Virginia Vocational Education Follow-Up Form.

In 1972, the General Assembly of Virginia enacted a set of standards of quality and objectives for public schools. It is anticipated that some revisions will be needed in VERS for 1974-75 to facilitate the implementation of the standards of quality.

Relationship of Vocational Education Reporting System to Decision-Makers

Determination of Information Needs

The information needs of decision-makers differ at the local level as compared to the state level. At the local level, decisions are made concerning the organization and operation of educational programs. More specifically, these decision-makers are concerned with which programs to continue, which programs to modify, and which new programs to offer. A program planning model is being developed to aid in identifying more clearly the information needs and to assist in more effectively using the information.

At the state level, decisions are made regarding the approval of programs, the distribution of resources, and accountability for the results achieved. Information needs include such things as how many students are served by the various programs, how many students are disadvantaged and handicapped, and what the status of former students is. These information needs are determined by maintaining a close working relationship between the decision-makers and the system and by involving the decision-makers in determining revisions and modifications to be made in the system.

Utilization of Information

The data from VERS are primiarly collected and processed on an annual basis, except for mid-year preliminary enrollment information. Hence, there is no daily operational information.

On an annual basis, information is processed to show the enrollment by programs, the number of disadvantaged and handicapped students being served, the number of students in cooperative programs and the number in exploratory and orientation programs, and the number of students completing the program requirements. These data are used by the state staff in determining programs to approve, in funding patterns, and in accounting for the use of funds.

Information is also processed annually to show the number of former students entering the labor market, whether the students enter jobs in the field of training or related areas, the number and types of jobs held, migrational patterns, the value of their training in relation to their jobs, and the like. These data are used by the state staff in making an overall evaluation of the effectiveness of programs.

The information discussed above will be provided, as appropriate, to local decision-makers. It will provide a basis for developing the local five-year plans as required by the state standards of quality. The enrollment and follow-up data will also be provided to the State Advisory Council on Vocational Education. They will be useful to the Council in making its annual evaluation of vocational education programs, services, and activities.

The data from VERS are especially useful in making reports to the Governor, the State Board of Education, and the General Assembly. Data may be generated and provided for the Appalachian region, the state planning districts, the congressional districts, and various other subdivisions.

Operational Description of Vocational Education Reporting System

Input

As noted earlier, the operation of VERS is under the supervision of the Coordinator of Vocational Education Research and Statistical Information, SDE. This individual uses several forms to collect input data. The names of the forms, sources of data, methods of collection, and other information are given in Table 1.

The State Coordinator works with reporting system coordinators in each school division of the state in handling the student enrollment and program termination or completion forms. (These coordinators were appointed by division superintendents in response to a request from the State Director of Vocational Education.) The division coordinators receive the forms and teacher's guides, distribute them to schools and teachers, collect the completed forms, and forward them to the State Coordinator. (In large divisions, coordinators are often appointed for

Table 1. Input Data

Input	Source of Data	Method of Collection	Method of Entry	Frequency of Collection	Output Report Number and Destination
Student Enrollment (Appendix A)	Students and Teachers	In class	Optical Scanning	Yearly	Termination or Completion Form: Preliminary Enrollment List; O.E. 3138
Program Termination or Completion Form (Appendix B)	Teachers	In school	Key Punch	Yearly	O.E. 3138; Final Enrollment Figures
Follow-Up Form (Appendix C)	Students	Mail-out	Key Punch	Yearly (six months after students leave school	O.E. 3139
Adult Enrollment (Appendix D)	Teachers	In school	Key Punch	At the end of a course	O.E. 3138; O.E. 3139

each school.) Figure 3 shows the flow of enrollment and termination or completion data.

The completed student enrollment forms are processed by an optical scanner, edited by computer with inconsistencies being removed and with computer-generated identification numbers being assigned for those students with no social security number, and stored on magnetic tape. As new students enroll during the year (after the September 30 initial enrollment), the forms are processed and the data added to the enrollment file. In the spring of the year, information is drawn from the enrollment file to prepare the termination or completion forms. These forms are examined by teachers who make the necessary corrections and indicate the status of students. The corrected forms are returned, and the master tape is up-dated by adding the corrections and student status information. At the end of the school year, the master tape contains up-to-date information on all students who were enrolled in each program during the year.

The adult enrollment forms are sent to the individual in each school division designated to handle reimbursement for adult vocational programs. This individual makes sure that a copy of the form is completed and mailed to the appropriate state supervisor upon completion of each adult course. After extracting information for reimbursement purposes, the state supervisor of each service forwards the forms to the State Coordinator's office. The data are keypunched on cards, and a tape is created.

The follow-up forms are mailed directly to the former students in the fall. Students eligible to be followed up are selected from the master file. A random sample of the eligible students from each vocational service is drawn, and the names and addresses are printed out. After the names and addresses are checked manually for readability and corrections have been made, address labels are made by the printer. Appendix C shows an address label attached to the material and describes the information on the label. After labels are attached, the forms are folded and mailed in a window envelope. The envelope contains the form, a letter from the State Coordinator, and a business reply envelope. Two weeks after the original mailing of the forms, cards are sent to the students thanking those who have returned the forms and requesting those who have not to do so. In two more weeks, another form is sent to those who have not replied. Data from the follow-up forms are punched onto cards, and a file is prepared.

Output

Using the information on master enrollment files, adult files, and follow-up files, several standard reports are made. The description of the reports is given in Table 2. In general, non-standard listings and tabulations can be made of all the data. Since the records are not keyed with special descriptions, there is no provision for a Boolean-type search.

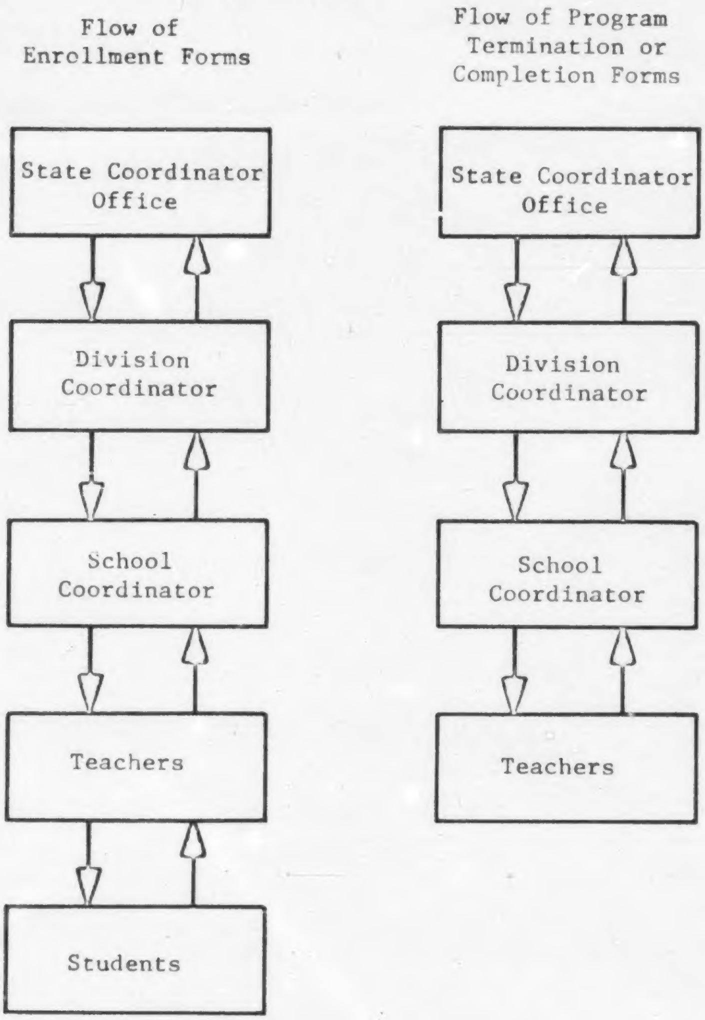


Figure 3. Collection Route of Student Enrollment and Program Termination or Completion Data

Table 2. Output Data

Output	Frequency of Report	Organizations and Officers Who Receive Reports on a Regular Basis	Organizations and Officers Requesting Reports
O.E. 3138	Yearly	U.S.O.E. through the State Director's Office	State Director
O.E. 3139	Yearly	U.S.O.E. through the State Director's Office	State Director
Disadvantaged and Handicapped List	Yearly	State Supervisors, State Director	State Supervisors, State Director
Enrollment by Programs	Yearly		State Advisory Council

Resource Requirements

The resource requirements to operate VERS are given in Table 3. The resources are categorized under personnel, hardware, and software. The operation is classified under data collection, data processing, data storage, and data displays and reports. The resources are not used exclusively for one operation but may be used in all operations. VERS is built around the resources (except personnel) available at the Virginia SDE. Though the resources stated in Table 3 do not suggest a minimum, the resources are necessary to operate VERS effectively.

General Discussion and Critique of Vocational Education Reporting System

The objectives of VERS have been generally fulfilled. There has been a reduction in the reporting tasks of teachers since (1) most of the student information is collected directly from the students, (2) a record of the students who complete the program requirements prior to the year they graduate is maintained, and (3) the follow-up is conducted by mail directly with the students. The procedure for collecting the data is more streamlined and is uniform for all vocational services. Machine processing of the data has reduced the time required by the state staff in tabulating data by hand and has made the data more readily accessible for use. From indications thus far, it appears that the accuracy of the data has been improved.

VERS meets the greater portion of the needs of educational decision-makers. With the recently enacted state standards of quality, some modifications as discussed below are needed. These changes will enable the system to meet the needs of state-level decision-makers and will provide more detailed information to local decision-makers.

Since an optical scanning form is used, there are the usual errors in marking the forms. The errors most frequently made thus far are the use of incorrect code numbers, allowing marks to extend outside the perimeter of the boxes or marking circles or dots in the boxes, and the omission of program information by teachers. Training sessions for teachers and experience by both students and teachers in using the forms should greatly reduce the number of errors. Most importantly, perhaps, the number of errors was not great enough to consider discontinuing the use of a scanning form.

Feedback from decision-makers on the operation of VERS is quite favorable. Thus, plans are to continue operating the system with no major revisions. The system is responsive to change, and only minor revisions are anticipated. For example, a revision is planned to enable the system to supply information on average daily membership of students by courses. The flow of forms and information from the state level to local coordinators has worked smoothly, and no changes are anticipated.

Table 3. Resource Requirements

Operation	Personnel			Hardware	Software
	Number	Time	Estimated Cost		
Data Collection	5	13½/mo.	$1,640/mo.	Opscan 100; IBM 360/25 (32K), 2-2400 tape units, 3-2311 disc units, 1-1403 printer, 1-1442R key punch	COBOL; all programs require 32K core; IBM utility programs
Data Processing	4	39/mo.	$2,681/mo.	Same as above	Same as above
Data Storage	2	24/mo.	$1,800/mo.	Same as above	Same as above
Data Displays and Reports	2	24/mo.	$2,300/mo.	Same as above	Same as above

While VERS is designed to collect information on vocational programs and students, it could be adapted for all types of education. VERS could be easily implemented in other states, and the SDE and VEEP staffs are willing to assist in such efforts.

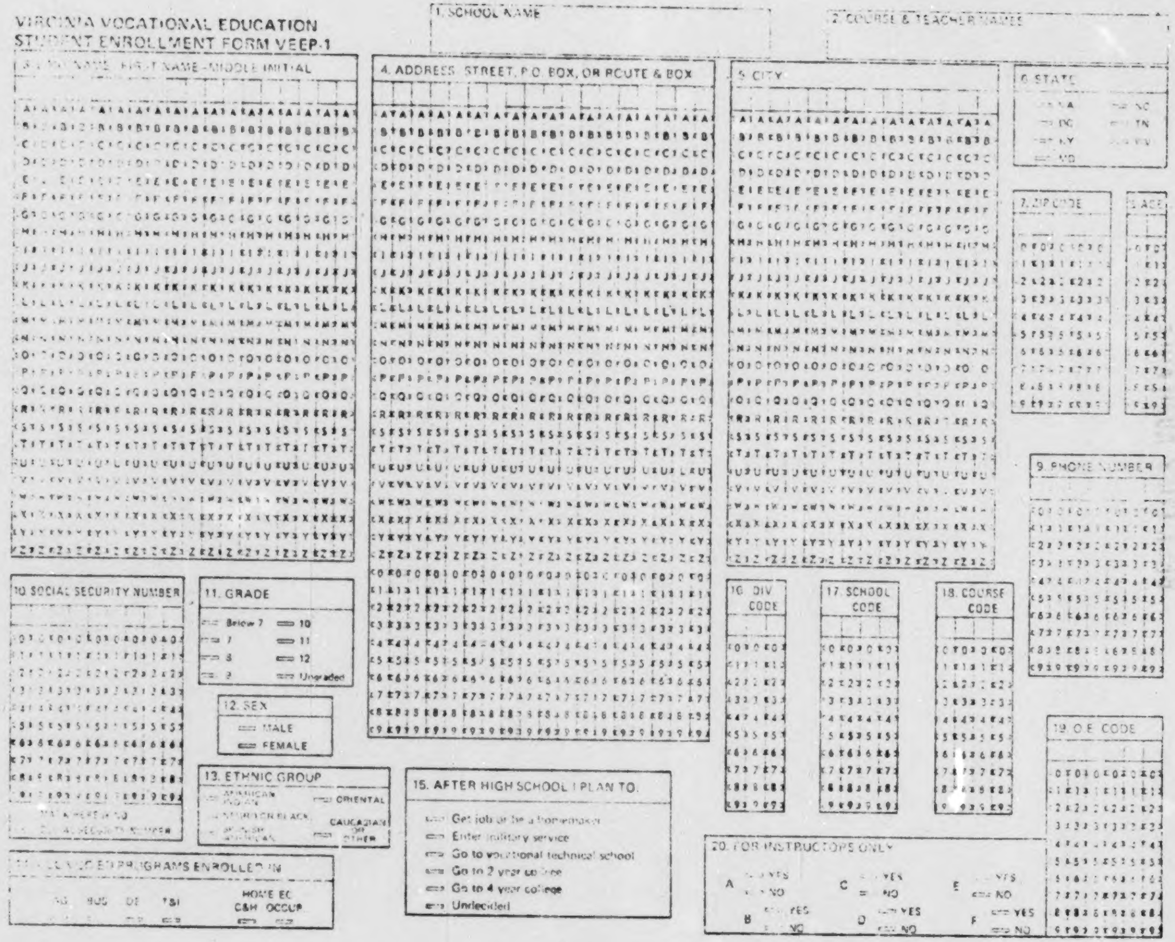
APPENDICES

APPENDIX A

VIRGINIA VOCATIONAL EDUCATION STUDENT ENROLLMENT FORM

(1972-73 SCHOOL YEAR)

BEST COPY AVAILABLE



VIRGINIA VOCATIONAL EDUCATION
STUDENT ENROLLMENT FORM VEEP-1

1. SCHOOL NAME

2. COURSE & TEACHER NAMES

3. LAST NAME - FIRST NAME - MIDDLE INITIAL

4. ADDRESS STREET, P.O. BOX, OR ROUTE & BOX

5. CITY

6. STATE
- VA
- DC
- KY
- MD
- NC
- TN
- WV

7. ZIP CODE

8. AGE

9. PHONE NUMBER

10. SOCIAL SECURITY NUMBER

11. GRADE
- Below 7
- 7
- 8
- 9
- 10
- 11
- 12
- Ungraded

12. SEX
- MALE
- FEMALE

13. ETHNIC GROUP
- AMERICAN INDIAN
- NEGRO OR BLACK
- SPANISH AMERICAN
- ORIENTAL
- CAUCASIAN OR OTHER

14. VOC ED PROGRAMS ENROLLED IN
- AG
- BUS
- DE
- T&I
- HOME EC C&H
- HOME EC OCCUP

15. AFTER HIGH SCHOOL I PLAN TO.
- Get job or be a homemaker
- Enter military service
- Go to vocational technical school
- Go to 2 year college
- Go to 4 year college
- Undecided

16. DIV CODE

17. SCHOOL CODE

18. COURSE CODE

19. O.E. CODE

20. FOR INSTRUCTORS ONLY
- A YES / NO
- B YES / NO
- C YES / NO
- D YES / NO
- E YES / NO
- F YES / NO

DC 30 103

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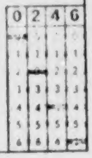
DIRECTIONS FOR STUDENTS
REPORT FORM VEEP-1

Virginia Vocational Education
Student Enrollment Form

SAMPLE MARKS

USE A NUMBER
2 PENCIL ONLY

DO NOT FOLD
OR STAPLE



A. Use No. 2 pencils. Any errors should be erased completely. Please do not make any unnecessary marks. Do not use ball point pen.

B. Where boxes are provided, write information in the boxes (one letter or number to a box), then blacken the letter or number below which matches each letter or number in the box. See example at right.

C. Item Explanation

Students are to complete items no. 1-19. Information to complete items 1, 2, 13, 14, 16, 17, 18, and 19 will be provided by instructor.

3. Student's Name--Enter last name. Leave an empty box after final letter of last name, do not blacken any space below the empty box. Begin first name in box immediately after the empty box. Leave an empty box after the first name. Write middle initial in box immediately after empty box. It is important that the middle initial be included in the name. In some cases the first name will have to be abbreviated to allow space for the middle initial.

Example: William M. Crinkelhouse

C	R	I	N	K	E	L	H	O	U	S	E		W		M		

Mary Q. Public

P	U	B	L	I	C		M	A	R	Y		Q					

4. Student's Address–Street Address, P.O. Box number, or box and route number. Abbreviate when necessary, especially words such as: West–W; Road–R; P.O. Box–POB or B; Rural Route–RR or RFD. Leave an empty box between sets of numbers or words.

Example: 1254 West Davenport

1	2	5	4		W		D	A	V	E	N	P	O	R	T		

Box 125, RFD 5

B	O	X		1	2	5		R	F	D		5					

5-9. Items are self explanatory.

10. Social Security Number–Enter social security number. If you do not have a number fill in box for "No Soc. Sec. Number."

11-12. Items are self-explanatory.

13-14. Information from instructor.

15. Indicate your plans as accurately as possible.

16-19. Information from instructor.

Thank you for your cooperation.

Division of Vocational Education
State Department of Education
Richmond, Virginia

DC 30 204

APPENDIX B

VIRGINIA VOCATIONAL EDUCATION PROGRAM TERMINATION OR COMPLETION FORM

BEST COPY AVAILABLE

VIRGINIA VOCATIONAL EDUCATION PROGRAM TERMINATION OR COMPLETION FORM VEEP-2
MAY,1972
PAGE 5

SCHOOL NAME APPOMATTOX INT.
DIVISION-SCHOOL NUMBER 006-0110
SERVICE HOME ECONOMICS EDUCATION
COURSE NAME HOMEMAKING I
COURSE NUMBER 8230

NAME		IDENTIFICATION NUMBER	OE-CODE	ITEM I EDUCATIONAL STATUS	ITEM II GRADUATION DATE *FOR A,B,D ONLY*	ITEM III EMPLOYMENT STATUS *FOR D,F ONLY*	ITEM IV REASON FOR WITHDRAWAL *FOR E,F ONLY*
ALLEN TERESA N E	L	999010086	070800				
AUSTIN TERESA	I	999010184	070301				
BAGBY FAYRENE		229868360	070301				
BOOKER BETTY	D	999010353	090199				
BOOKER JOLETTA	E	999010355	172602				
BOOTH JANET	M	225647035	140700				
BRYANT JUDY	L	999010481	070301				
CARTER ROBIN	D	999010558	140700				
CHANDLER KAREN	L	999010595	090199				
CHEATHAM BETTY	L	999010605	140700				
CHILDRESS CRYSTAL	L	999010611	041900				
CHILDRESS FRANCES	M	999010612	090108				
CHRISTIAN AMY	D	999010618	172602				
CLARK PEGGY	J	999010623	090199				
COLEMAN BEVERLY	A	999010655	070301				
COLEMAN CYNTHIA	D	999010656	140700				
COLLEY TAMMY	J	999010666	170700				
COVINGTON GOLDIE	M	999010726	079900				
CULPEPPER SYLVIA	G	999010771	070301				
CYRUS DONNA	L	999010790	140700				
DIXON MARY	A	999010891	041900				
EDWARDS MARILYN		999010974	090199				
FERGUSAN KATHY	N	999011030	090201				
FERGUSON JANICE	D	999011033	041900				
FERGUSON RITA	G	999011038	041900				
FURREST DARLENE	V	999011094	040700				
GAGNEUR JANICE	E	999011134	040900				
GARRETT DEBRA	A	999011153	090199				
GARRETT THREASA		229800844	041000				
GARRISS KATHIE	C	999011162	090199				
GODSEY NANCY	L	999011209	090199				
GOODWIN PAMELA	S	999011227	090199				
GUNTER REBECCA	L	999011291	170700				
HAMLIN SUSAN L		999011335	140700				
HANCOCK SANDRA	E	999011342	140700				
HARRIS CYNTHIA	L	999011372	090199				
HARVEY BEVERLY	D	999011389	090199				
HOKE NANCY	J	999011497	090199				
HUDSON LYNNETTE		999011563	172602				
JOHNSON BONITA	M	999011656	140700				
LAMPKIN MARGARET	A	999011849	070301				
LITCHFORD CYNTHIA	D	999011937	070301				

APPENDIX C

VIRGINIA VOCATIONAL EDUCATION FOLLOW-UP FORM AND COMPUTER-MADE ADDRESS LABEL

COMMONWEALTH OF VIRGINIA

STATE DEPARTMENT OF EDUCATION
RICHMOND, 23216

October 27, 1972

BEST COPY AVAILABLE

Dear Former Student:

Enclosed is the Virginia Vocational Education Follow-up Form, VEEP-3. Please complete the form immediately and return it in the enclosed business-reply envelope.

This follow-up of former students is the second part of a statewide reporting system for vocational education in Virginia. You participated in the first part of this system when you completed a blue and white optical-scanning form in one of your vocational classes last January or February. That form asked for your name, address, and information about your classes and school. All former students who completed a vocational program and terminated or graduated this year are to be contacted as part of the follow-up. According to our records, you are one of these former students.

Your responses on the questionnaire will provide information on what former students have been doing since leaving school and their attitudes toward vocational education. This information will be used to improve vocational programs in the State. You may be assured that your name will not be identified with any responses you give on the questionnaire.

Your cooperation in completing the questionnaire will be greatly appreciated.

Sincerely,

Carl E. Jorgensen

Carl E. Jorgensen, Coordinator
Vocational Education Research and
Statistical Information

CEJ/psh

Enclosures

VEEP-3

VIRGINIA VOCATIONAL EDUCATION FOLLOW-UP FORM

A SURVEY OF FORMER VOCATIONAL STUDENTS

CC

1-9 Student and Vocational Program Identification

Your Social Security Number ☐☐☐-☐☐-☐☐☐☐

Is your name and address correct as printed above?
If not, please print the corrected information below:

New Name____
Last Name First Name Middle Initial

New Address______________________________________
Number and Street or Rural Route

____
City, Town, or Post Office State (abbr.) Zip Code

DIRECTIONS:

Answer the questions with an "X" type check mark. Please return the completed form in the enclosed business reply envelope to Carl E. Jorgensen, Coordinator of Vocational Education Research and Statistical Information, State Department of Education, Richmond, Virginia 23216. You will not be identified with the responses you make on this questionnaire

---

10 1. Are you in the military service? _____yes _____no

If your answer is "yes," complete only items 20 and 21 of this form. If your answer is "no," please continue on with item 2.

11 2. Are you continuing your education at a higher level on a full-time basis?

_____yes _____no

12 3. Do you have a job now? _____yes _____no

If your answer is "yes," continue on with item 4. If your answer is "no," skip to item 8 and continue on with the remaining questions.

13 4. How many hours per week are you required to work on your present job?

_____Less than 30 hours _____30 hours or more

14 5. How do you feel about your present job? (check one)

_____Like it very much _____Neither like nor dislike it

_____Like it somewhat _____Dislike it very much

15 6. Do you think that you got your present job because of your vocational training in school?

_____yes _____no

16 7. In your present job how often do you use the knowledge and skills acquired from your vocational training?

_____Frequently _____Occasionally _____Seldom _____Never

17 8. If you are unemployed now, are you looking for a job?

_____yes _____no

18 9. How many jobs have you had since leaving high school?

_____none _____one _____two _____three _____four _____five or more

If your answer is "none," skip to item 20. If your answer is one or more jobs, continue on with item 10.

19 10. Was your first job in the field for which you were trained?

_____yes _____no

20 11. If your first job was not in the field for which you were trained in school, why was it not in that field?

_____Tried, but couldn't find a job
_____Couldn't get into apprentice program
_____Better type job came along first
_____Didn't want that type of work
_____Instructor advised against it
_____Other reason: (Explain)________________________________

21 12. If it took longer than you expected to find your first job, what was the most important reason?
_____No jobs available in the community
_____Wasn't interested in the jobs available
_____Parents wanted me to stay at home
_____Lacked skills or other qualifications for the jobs available
_____Was too young
_____Got married
_____Went to college
_____Other (specify)______________________________

13. Who helped you find your first job? (check all that apply)
22 _____Vocational teachers
23 _____Guidance counselors
24 _____Other teachers
25 _____Placement service at school
26 _____State employment service
27 _____Relatives
28 _____Others
29 _____Found it myself

30 14. How many hours per week were you required to work on the first job?
_____Less than 30 hours _____30 hours or more

15. What was the title of your first job?______________________

31 16. How well did your vocational training prepare you for your first job?
_____Very well _____Average
_____Good _____Poorly

32 17. How far from your high school was your first job located?
_____0-10 miles _____51-100 miles
_____11-25 miles _____101-200 miles
_____26-50 miles _____more than 200 miles

33 18. What was the starting pay (before deductions) on your first job?
_____Under $50 per week _____$101-$125 per week
_____$51-$75 per week _____$126-$150 per week
_____$76-$100 per week _____$151-and over per week

34 19. If you left your first job, what was the main reason for your leaving the job?
_____Laid off (lack of work) _____Quit (no future in it)
_____Laid off (other reason) _____Quit (no other reason)
_____Quit (disliked type of work) _____To get married

35 20. If you were to start all over again, what area of education would you select?

_____Same vocational education field
_____Different vocational education field--Specify__________
_____Non-vocational education field

21. Please rate your former school on each of the items below. Base your rating on your experience since leaving school.

	Item	Rating			
		Excellent	Good	Fair	Poor
36	Quality of vocational instruction	____	____	____	____
37	Quality of academic instruction	____	____	____	____
38	Physical condition of school	____	____	____	____
39	Physical condition of shops/lab	____	____	____	____
40	Availability of tools and equipment	____	____	____	____
41	Teacher interest in students	____	____	____	____
42	Student guidance/counseling	____	____	____	____
43	Job placement service	____	____	____	____
44	Availability of vocational programs	____	____	____	____
45	Information about job opportunities	____	____	____	____
46	Library facility	____	____	____	____

THANK YOU FOR YOUR COOPERATION

VOCATIONAL EDUCATION FOLLOW-UP LABEL

1 Social Security Number	2 Term. Code	3 D-H Code
4 5 6 Voc. Prog./OE Code/Div.-School Code		
7 Name		
8 Address		
9 City	10 State	11 Zip Code

2. Termination Codes:

1 - Graduation and completion
2 - Graduation, non-completion, and employed in field of training or related field
3 - Non-graduation, completion
4 - Non-graduation, non-completion, and employed in field of training or related field

3. D-H Codes:

0 - Neither disadvantaged nor handicapped
1 - Disadvantaged
2 - Handicapped

4. Vocational Programs (right-justify):

AG
BUS
DE
HE (occ. only)
TI

10. Always Virginia

APPENDIX D

VIRGINIA VOCATIONAL EDUCATION ADULT ENROLLMENT FORM

VEEP-4
VIRGINIA VOCATIONAL EDUCATION
ADULT ENROLLMENT FORM

I. Type of Program--check only one

(check the one that most accurately describes the program)

☐ Adult Preparatory

☐ Adult Supplementary

☐ Apprenticeship

II. Location of the program

1. Location: Name of high school, vocational school, industry or other place: ______________________________
2. Division Code: ___ ___ ___
3. Instructor's Name: ______________________________
4. Instructor's Social Security Number: _ _ _ - _ _ - _ _ _ _

III. Program description

1. Instructional Program Title: ______________________________
2. (a) Date classes began ________ ________ ________
   Month Day Year

   (b) Date classes ended ________ ________ ________
   Month Day Year
3. (a) Total number of class sessions: __________

   (b) Hours per session: __________

IV. Miscellaneous

This program was offered because (check one):

____ It is a standard course offered at regular intervals.
____ It was requested by a local industry.
____ It was requested by local business groups.
____ It was requested by local people or advisory committee.
____ Other reason (specify) ______________________________

V. Student characteristics (report all students who enroll):

1 Category	2 O.E. Code	Number in each classification									
		3 Sex		4 Ethnic Group*					5 Employment Status**		
		Male	Female	AI	O	SA	N	C	FT	OT	U
Regular											
Disadvantaged											
Handicapped											

*AI = American Indian; O = Oriental; SA = Spanish American; N = Negro or Black; C = Caucasion or Other.

**FT = Employed in the field of training or related field; OT = Employed outside the field of training; U = Unemployed.

MANPOWER DEMAND/SUPPLY

THE KANSAS MANPOWER UTILIZATION SYSTEM FOR TRAINING (MANPOWER DEMAND MODULE)

JAMES L. HARRIS

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OVERVIEW OF THE TOTAL KANSAS MANPOWER UTILIZATION SYSTEM FOR TRAINING

The purpose of this paper is to describe the Demand Module (Subsystem) of the Kansas Manpower Utilization System for Training (K-MUST). To understand the environment which limits the module's design, it is necessary to present an overview of the total K-MUST System. This is followed by a general outline of the Demand Module, a discussion of the relationships between the module and users, and an operational description of the module. Finally, a critique of the module is provided.

Historical Development

In the spring of 1971, R. B. Daniels and John Snyder of the Kansas State Department of Education formally identified the need for a vocational education management information system. At their request, Kansas State University assumed responsibility for the development of such a system in September of the same year.

The University recruited experienced systems analysts from other states to staff the project. Using the needs of Kansas as parameters, this staff reviewed all state-level vocational education management information systems operating at that time. The OTIS project in Oklahoma was selected as a model which, with modifications, would meet the requirements of Kansas.

During the first five months of the development phase, all elements of the OTIS system were reviewed in detail, and a technical plan was developed for the Kansas system. In addition, other data sources which were producing related information in the state were identified, and every effort was made to assure that modules of K-MUST did not duplicate the work of these other sources.

Using makeshift techniques and the other data sources to generate information, a first annual K-MUST report was published in January, 1972. The general purpose of this report was to develop local administrator awareness of the project and its goals. Throughout 1972, modules were designed and tested, and in January, 1973, a second annual K-MUST report was published. This second report was enthusiastically received by many vocational education decision-makers in Kansas, and 1200 copies were requested within five months after its release.

Organization and Design

With the publication of the second annual report, the K-MUST staff shifted emphasis from the development of information-producing modules to (1) the refinement of technology, (2) the development of management tools with which to use better the information produced, and (3) the operation of the system. Documentation of the system was completed in October of 1973, and a report on the research and development phase was published in November of the same year.

In September, 1973, administration of the system was moved to the Kansas State Department of Education. The technicians operating the system are presently located at Kansas State University where resources such as the Computer Center are readily available. These technicians are considered to be part of the State Department of Education staff.

Figure 1 presents the organizational structure of the Kansas State Department of Education relative to the K-MUST system. The System Coordinator is directly responsible to the Management Information Unit Director and supervises four clerical workers. The System Coordinator is also responsible for coordination with related research projects and service organizations at Kansas State University.

Future Plans

In September of 1974, the technicians operating the system will be moved from their present location at Kansas State University in Manhattan to the state capitol in Topeka. Service resources at Kansas State University will continue to be utilized. Future funding will be at approximately the same level as in the present year.

Overview of the K-MUST Subsystems

The following modules are subsystems of the total K-MUST system.

1. Student Accounting System Module

This module is the technique used to gather, process, and report data on enrollments, completions and placements relative to public school programs funded under the 1968 Amendments to the 1963 Vocational Education Act. Federal OE 3138 and OE 3139 reports are among the major outputs generated through this module. Other outputs include data for the State Plan, data for legislative purposes, data for the annual K-MUST report, Enrollment, Completion and Placement Summaries for the Evaluation Module, and other student-related reports as required.

The module uses a three-part program enrollment form from which data are keypunched to generate initial enrollment information on each student. Special, pre-printed, computer cards are used to gather completion and placement data. Teachers are responsible for gathering completion and placement data on the programs which they teach. The system can accommodate a one-, three-, and five-year follow-up as required.

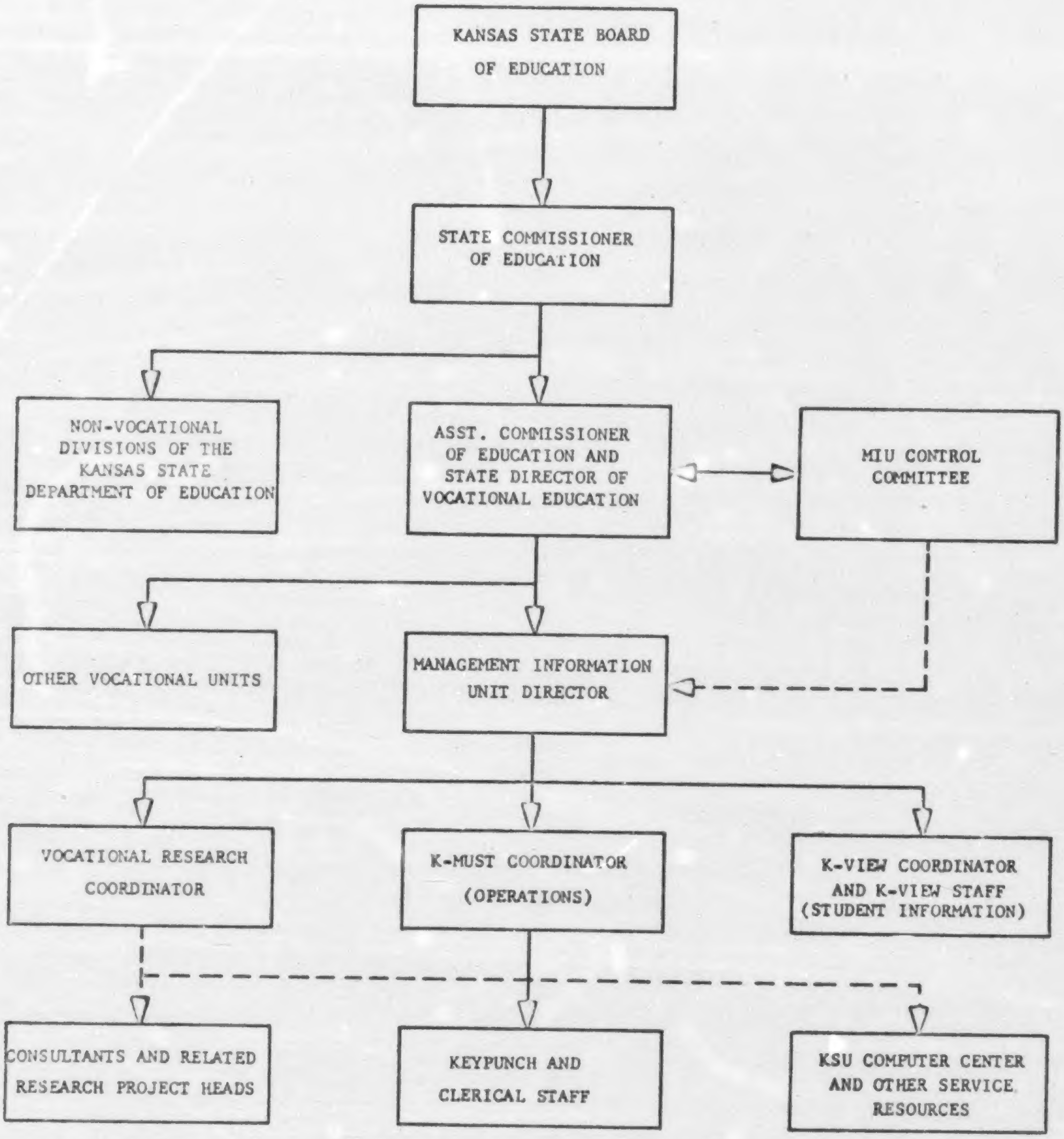
KANSAS STATE BOARD OF EDUCATION
STATE COMMISSIONER OF EDUCATION
NON-VOCATIONAL DIVISIONS OF THE KANSAS STATE DEPARTMENT OF EDUCATION
ASST. COMMISSIONER OF EDUCATION AND STATE DIRECTOR OF VOCATIONAL EDUCATION
MIU CONTROL COMMITTEE
OTHER VOCATIONAL UNITS
MANAGEMENT INFORMATION UNIT DIRECTOR
VOCATIONAL RESEARCH COORDINATOR
K-MUST COORDINATOR (OPERATIONS)
K-VIEW COORDINATOR AND K-VIEW STAFF (STUDENT INFORMATION)
CONSULTANTS AND RELATED RESEARCH PROJECT HEADS
KEYPUNCH AND CLERICAL STAFF
KSU COMPUTER CENTER AND OTHER SERVICE RESOURCES

Figure 1. Organizational Structure of Kansas State Department of Education Relative to the K-MUST System

2. Non-Public Supply Module

This module is a composite of three sub-modules designed to collect manpower supply data from (1) public programs not funded under the 1968 Amendments, (2) private schools, and (3) MDTA programs; Apprenticeship programs (other than those adult supplementary programs funded under the 1968 Amendments); and Bureau of Corrections programs. Only enrollment data are collected from these sources, with completion and placement figures being estimated using past research.

3. Manpower Demand Projection Module

The technique used to project manpower demand is a modified version of the BLS matrix approach. Dun and Bradstreet Market Identifiers (R), Employment Security Commission unemployment insurance records, and other readily available sources of information are used to estimate employment by standard industrial classification in the state and 11 regions within the state. Using factors found in the BLS matrix (modified for use in Kansas), employment by standard industrial classification is broken into employment by occupation, and estimates of expansion needs are projected. Using factors related to the matrix, an estimate of replacement needs for each occupation is generated. Total manpower needs are the sum of expansion needs and replacement needs. Data generated using this technique are within accuracy parameters established by the Kansas State Department of Education.

4. Placement Module

This module utilizes the firm identification data purchased from Dun and Bradstreet, Inc., to inform potential employers about graduates, and graduates about potential employers. The 500 largest (in terms of number of employees) firms in Kansas are mailed lists of training programs. These lists contain type and location of the program, name of the teacher, expected number of graduates and expected graduation date. Graduates have access to a list of potential employers by standard industrial classification generated from the Dun and Bradstreet Market Identifiers (R). The purpose of this module is to establish contact between graduates and potential employers with the goal of a higher placement rate.

5. Upgrading Training Needs Projection Module

This module projects the need for training to upgrade the skills of workers in the Kansas work force. Data collected from 1,800 Kansas employers along with occupational profiles developed by the Manpower Demand Projection Module are used to produce these projections. The Kansas employers are asked how often employees of certain types needed upgrading training. Their answers are compiled into a percentage of employees (by occupation) who need upgrading annually. Additional information, such as who should be responsible for the training, is incorporated in the output.

6. Cost/Benefit Module

This module is a simple technique for evaluating training programs in terms of payback periods and long-run accrued benefits. Here, payback period is defined as that time required for the graduate to produce enough extra (above and beyond what he would be expected to produce without training) to equal the cost of his training plus the foregone productivity related to his time in training. Long-run accrued benefits are defined as the difference between what the graduate is expected to produce and what he would have been expected to produce without training.

7. Potential Student Module

This module provides techniques for projecting the number of persons who are potential vocational or technical students by county within the state. The number of disadvantaged and handicapped by county is estimated, too. The U. S. Census Report and the State School Statistical Report are also used as input into this system.

8. Student Interest Module

This module provides a way to rank various program clusters by student interest. In this context, student interest is measured by the number of K-VIEW references per occupational cluster. (Note: K-VIEW is a student information system through which students can obtain information about specific occupations at their convenience.) Program clusters with a high number of K-VIEW references are said to rank high in student interest, while a low number of references is said to indicate a low student interest rank.

9. Facility Usage Module

This module is a technique for evaluating the use of facilities in terms of number of students served per square foot, work station, etc. The module provides an interesting insight into how, when and to what extent various facilities are utilized.

10. Handicapped and Disadvantaged Module

This module is a software package which can be used with the Student File generated by the Student Accounting System Module to produce an analysis of the participation rates of disadvantaged and handicapped students by "program type," school, and individual program. This type of data is used in the OE 3138 and OE 3139 reports and in the Budgeting Module.

11. Interfacing Module

This module is the technique used to match manpower demand data and manpower supply data. Occupations and training programs are not always an obvious match. Using course descriptions and the expert opinions of state supervisors, a system of grouping occupations with related training programs has been developed for Kansas.

12. Interstate Coordination Module

This module is a technique for combining data from adjacent states with Kansas data to be used by vocational education planners who organize training which serves two or more states. The principal use for this module in Kansas is in the Kansas City, Kansas-Kansas City, Missouri area.

13. The Optimum Program Mix Module

The development of a module that can be used to determine the optimum program mix in a given geographical area involves identifying variables that tend to determine or restrict the program mix. A structured manipulation of these variables should yield the optimum program mix relative to some predetermined goal, e.g., maximization of students placed.

Variables that were identified for manipulation within the model are (1) cost per program, (2) total available vocational and technical education financial resources, (3) number of students interested in particular programs, (4) number of programs of certain types needed to meet manpower needs, (5) number of students a particular program can serve, (6) student population to be served, and (7) number of students expected to be placed into employment (for which they were trained and by program type).

Several approaches were considered in the model development, and linear programming was selected as the most feasible alternative. Linear programming concerns itself with the efficient use or allocation of limited resources to meet desired objectives where solutions satisfy both the conditions of the problem (constraints) and the given objective in terms of the most optimum solution.

The objective to be optimized can be any one of several variables. Possibly some of the more feasible objectives would be to maximize the number of students placed in occupations related to their training, the number of disadvantaged and handicapped students being served, or societal cost-benefit ratios.

14. Program Application Evaluation Module

This system is designed to evaluate program applications on the basis of up to 19 criteria determined by state supervisors. (Note: Program applications are submitted annually for both new and established programs.) Since all criteria are not of equal significance, each criterion is weighted. Weights have been established by a representative panel of administrators.

There are two types of data used as input in this system, i.e., weights for criteria and criteria values for each program. Each criterion is assigned a weight, and criterion values relative to each program are calculated. The following formula is used to derive a program rating for each program application form.

$$\text{Program Rating}_i = W_1X_{1,i} + W_2W_{2,i} + W_3X_{3,i} + . . . + W_{19}X_{19,i}$$

In this formula, Program Rating$_i$ refers to the rating of a particular program (i), W_j refers to the weight of criterion (j), and $X_{j,i}$ refers to the value of criterion (j) for program (i).

Reports produced are:

1. a rank ordering of all established program applications by program rating,
2. a rank ordering of all new program applications by program rating,
3. a rank ordering of established program applications by program rating within program type,
4. a rank ordering of new program applications by program rating within program type, and
5. analysis of each program application relative to other programs, one copy of which is returned to the applying school.

15. Budgeting Module

This system is directly tied to the Program Application Evaluation Module and is based on the philosophy that if a program is worth approving, it is worth funding at an operational level. The base allotment (operating budget) is composed of two types of funds, i.e., local money available to finance the program and state and federal money needed to bring the funds available up to the operating level. An operating budget is determined, and the local money available is compared to this figure. If additional money is needed to bring the available funding to the operating level, then state and federal money is added as needed. When an institution is making less than a maximum effort to fund the program with local funds, the state makes less than a maximum effort to provide the additional funds needed for the operating level. This reduction in state effort is directly proportional to the reduction of local effort. Another type of money used to finance the programs above the operating level is incentive money, which is distributed on the basis of program application evaluation, with higher evaluation rating programs receiving more money. The incentive monies never constitute more than five percent of the total budget. Disadvantaged and handicapped funds are determined on the basis of number of disadvantaged and handicapped students enrolled at a certain number of dollars per student. These monies are not part of the operating budget or incentive funds and can be claimed only upon proof of additional costs required to supplement activities, services or materials which will enable disadvantaged or handicapped students to succeed in the program.

16. Data Dissemination Module

This module represents a technique for disseminating information produced by the other modules. Five dissemination procedures are incorporated into a system for getting information to the field and getting feedback from the field for the K-MUST staff.

The system modules described in the preceding section can be integrated to provide a comprehensive management information/decision-making system. Integration, in this case, means that the modules are data-linked so that output from one module serves as input for higher-level modules. There are three levels of modules in the total system. The first level is basic data-generating modules which collect, process and analyze raw data. The second level is secondary data-generating modules which further analyze data produced by one or more first-level modules. The third level is data-using modules where inputs from other modules are used to produce a decision based on flexible criteria or criterion weights.

Figure 2 depicts the integration relationships among modules in the K-MUST system. Manpower supply data from both public and non-public sources (modules 1 and 2) are combined with manpower demand data (module 3) in the interfacing module (12) to estimate net manpower needs. This output and upgrading training needs (module 5), cost/benefit information (module 6), potential student data (module 7), and student interest data (module 8) are combined to determine the optimum program mix for Kansas or a geographic area in Kansas (module 13). It should be noted that the program mix can be optimized relative to a number of variables, foremost of which are graduate placement and program cost/benefit ratios. The optimum program mix data are combined with facility usage data (module 9) and input from adjacent states (module 11) to evaluate established and proposed program applications (module 14). This output, in conjunction with handicapped and disadvantaged enrollment data (module 10), is used for the development of program budgets (module 15). Handicapped and disadvantaged enrollment data were derived from the public school student accounting module (1). Information to facilitate the placement of graduates (module 4) is obtained from demand data (module 3). Dissemination and feedback are achieved in module 16.

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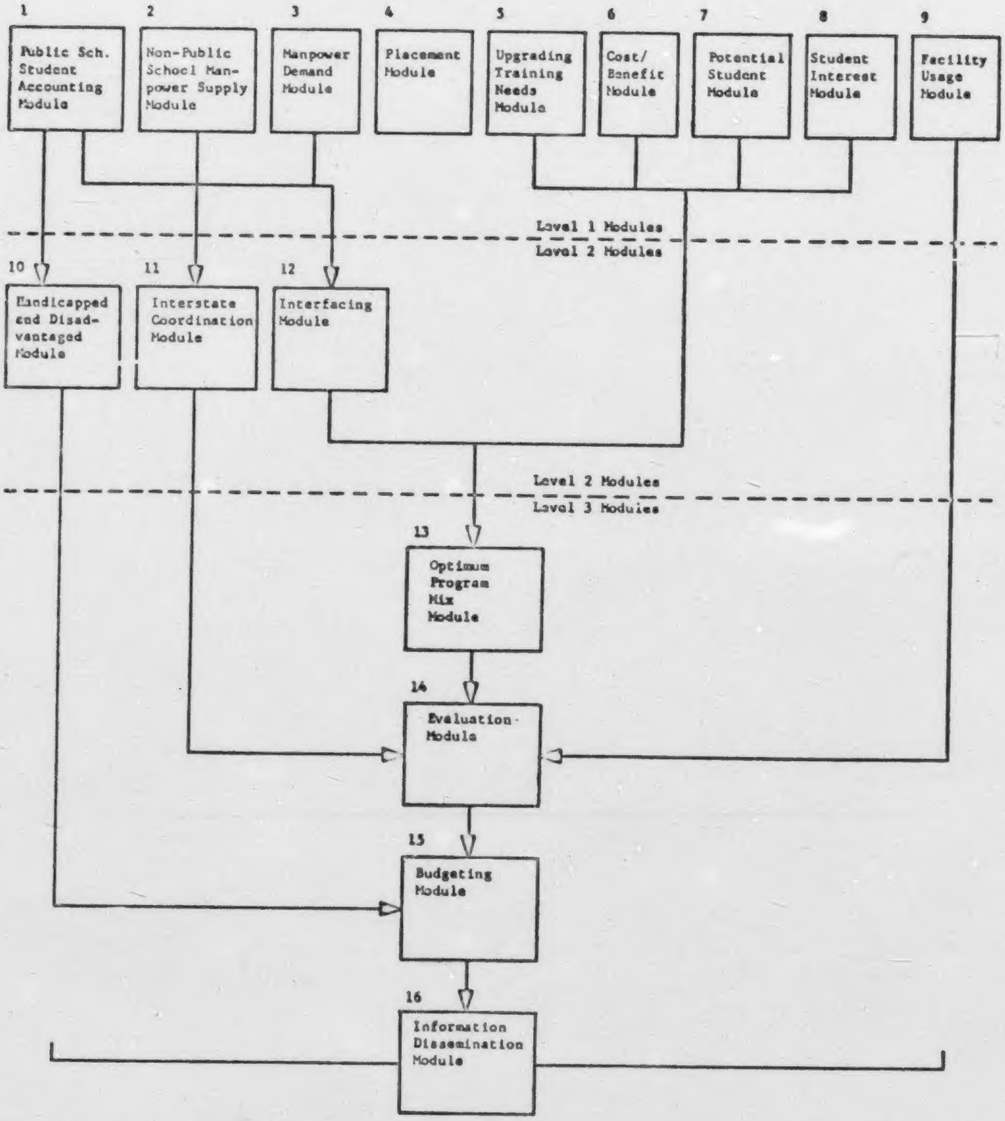

Figure 2. Integration Relationships Among K-MUST Modules

It should be noted that since many of the modules are stand-along systems, the data linkages presented here are not necessarily fixed. Additionally, many other data needs can be satisfied through indirect software links with the data bank.

Objective of the Demand Module

The Demand Module of the K-MUST System has the single objective of producing manpower needs projections by occupation for 11 regions in Kansas and the state as a whole. Parameters within which the module must operate include:

1. cost to produce projections must be financially feasible;
2. the module must be a real time system, i.e., data must be available when they are needed; and
3. data produced by the module must be within accuracy parameters established by the State Department of Education.

Organization

All vocational education administrators, counselors, and teachers in the state have access to the data produced by the module. The principal users are staff members of the Kansas State Department of Education who make decisions about vocational program approval and budgeting. It should be noted that without the approval of the State Department, local schools cannot spend local vocational education tax levies. Secondary users include (1) local school administrators who use the data to develop program applications and (2) counselors who use the data in conjunction with their routine activities.

The K-MUST staff is directly responsible for collection and processing of data used to make projections; however, the State Director has the ultimate responsibility of deciding when projections will be made, for what purposes they will be made, and what parameter years will define the projection periods. In making these decisions, he may rely on the advice of the K-MUST Director, the Management Information Unit Director and the Control Committee.

It costs about $5,000 per year to make projections. Of this amount, $3,000 is spent to purchase Dun and Bradstreet Market Identifiers (R), $1,500 to collect and prepare supplementary data, and $500 to cover computer costs. If more than one set of projections is produced annually, the additional cost is about $500 per additional set. Additional projections are normally run for outside government organizations based on different parameter years.

Since the State Department of Education is the principal user of the data, funding for the projections comes from Part B money at the state level. Any special runs made for outside organizations are paid for by the requesting organization.

General Description

Under the initial contract between the Kansas State Department of Education and Kansas State University, demand data were to be generated using an employer survey approach similar to that used by OTIS in Oklahoma. It soon became apparent, however, that Kansas could not financially afford to survey employers in this manner, and a new approach was suggested. The suggested approach was a modified version of the Bureau of Labor Statistics Matrix Method A.

The idea for the new approach was conceived after reviewing the work done by McNamara in Pennsylvania in 1969.[1] McNamara had applied matrix ratios to work force data to derive rough estimates of occupational profiles and expected needs for a limited number of occupations. Although this work was crude and the idea seems obvious now, it was a monumental break-through as far as the Kansas system is concerned.

The State Director agreed to try the new approach in a test situation. After two studies (one by the K-MUST staff and one by the State staff) indicated that the average error in profile estimates was between five and ten percent, the State Director approved the modified matrix technique to be used in Kansas.

It cost approximately $12,000 to develop and test the technique. Of this amount, $9,000 was spent to collect and prepare input data, and $3,000 was used to develop computer software. These costs were paid by the Kansas State Department of Education as part of the contract with Kansas State University.

A simplified explanation of what takes place within the modified Bureau of Labor Statistics (BLS) approach developed by the K-MUST staff is best represented by utilizing a flow chart (Figure 3).

In step 1 of the modified matrix technique, all employing organizations in the labor market are identified by standard industrial classification (SIC) code and number of employees. The data on individual organizations are based on Dun and Bradstreet Market Identifiers (R), unemployment insurance account records, government directories, Department of Agriculture studies, and other state-based studies. These data are accumulated into number of employees in a particular type of industry (SIC).

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[1] J. F. McNamara. Vocational, Technical, and Continuing Education in Pennsylvania. Pennsylvania Department of Public Instruction, 1969.

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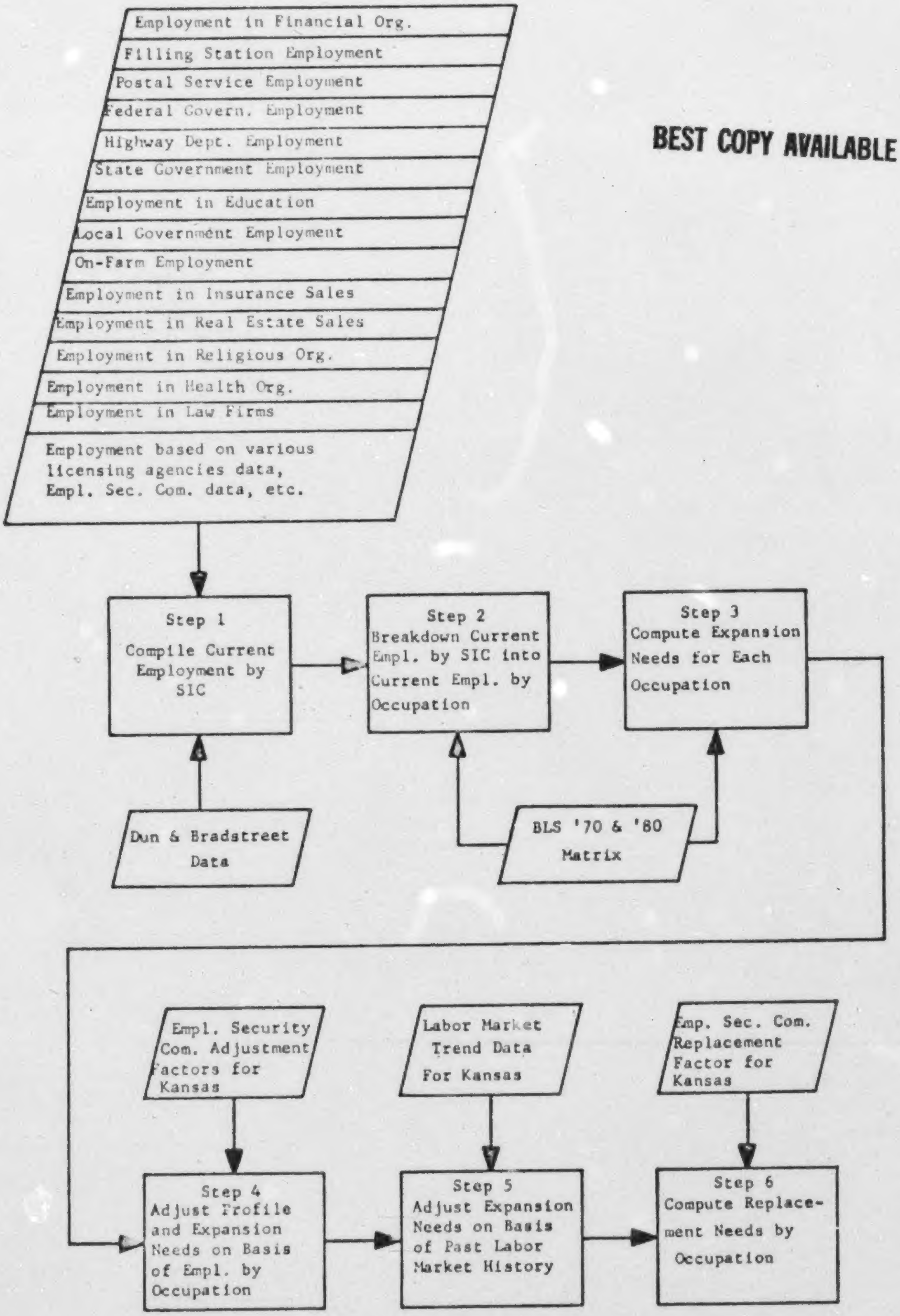
Employment in Financial Org.
Filling Station Employment
Postal Service Employment
Federal Govern. Employment
Highway Dept. Employment
State Government Employment
Employment in Education
Local Government Employment
On-Farm Employment
Employment in Insurance Sales
Employment in Real Estate Sales
Employment in Religious Org.
Employment in Health Org.
Employment in Law Firms
Employment based on various licensing agencies data, Empl. Sec. Com. data, etc.
Step 1 Compile Current Employment by SIC
Step 2 Breakdown Current Empl. by SIC into Current Empl. by Occupation
Step 3 Compute Expansion Needs for Each Occupation
Dun & Bradstreet Data
BLS '70 & '80 Matrix
Empl. Security Com. Adjustment Factors for Kansas
Labor Market Trend Data For Kansas
Emp. Sec. Com. Replacement Factor for Kansas
Step 4 Adjust Profile and Expansion Needs on Basis of Empl. by Occupation
Step 5 Adjust Expansion Needs on Basis of Past Labor Market History
Step 6 Compute Replacement Needs by Occupation

Figure 3. Logic Chart of the Demand Module

In step 2, the occupational profile (number of workers by occupation) is derived by breaking employment by SIC into employment by occupation utilizing percentages generated from the BLS 60-70-80 matrix. As an example, suppose that bookkeepers constituted five percent of the workers in the wholesale clothing industry in 1970 and are estimated to constitute eight percent in 1980. Then, in 1973, approximately six percent of the workers in the wholesale clothing industry would be expected to be bookkeepers. If 1973 is the base year, then six percent would be multiplied times the number of workers in the wholesale clothing industry (from step 1) to estimate the number of bookkeepers in the industry. Finally, bookkeepers from all industries are summed to estimate total number of bookkeepers in all industries.

In step 3, which occurs simultaneously with step 2, expansion needs for each occupation in each industry are computed using percentages generated from the matrix. The expansion needs for each occupation are then summed. Continuing the example in step 2, the estimated number of bookkeepers in the wholesale clothing industry would be multiplied by the expansion rate for bookkeepers in that industry. (Note: An annual expansion rate is used and expanded in consideration of the number of years in the projection period selected.) Again, the expansion of bookkeepers for all industries is summed to estimate the total expansion of bookkeepers.

In step 4, both profile and expansion figures are adjusted on the basis of state-level data provided by the Kansas Employment Security Commission. This is, in effect, adjusting profiles and expansion to the Kansas situation. In the example, suppose that the state profile of bookkeepers estimated by the technique was 3,000, while the Kansas Employment Security Commission figure was 2,500. In this case, all regional bookkeeper profile figures would be decreased by one-sixth. On the other hand, suppose that the bookkeeper expansion rate was greater in Kansas than in the nation as a whole (as reflected in the matrix). Then the expansion rate in the regions would be increased after an adjustment for the profile decrease.

In step 5, the profiles and expansion needs are further adjusted to the local situation using regional labor market trend data provided by the Employment Security Commission. Suppose that the work force figure projected for the region is greater or less than that reported by the Employment Security Commission. Then each occupation in the profile is adjusted relative to the total work force for the region. Further, suppose that for a given region, the work force as a whole has historically expanded at a rate of two percent annually, while the adjusted matrix projections show that the work force is expanding at a rate of three percent annually. The expansion figure for bookkeepers would then be decreased by one-third for that region. (Note: Regional adjustments, of course, do not change the state figures, as the regions combined equal the state.)

In step 6, replacement needs are calculated using percentage factors provided by the Employment Security Commission, which are based on the occupational mobility of workers, the age of workers, and mortality figures. Suppose that the replacement factor for bookkeepers was two percent per year, and the projection period is five years. The average number of bookkeepers (base year plus expansion divided by two) over the period is multiplied by two percent times five (years) to estimate replacement needs.

Relationship of the Demand Module to Decision-Makers

Prior to contracting with Kansas State University for the development of the K-MUST system, all state supervisors in the vocational education area had agreed that there was a pressing need for a method to project manpower demand by occupation and region within the state. When it became apparent that the employer survey approach was not financially feasible for Kansas, the supervisors recommended that the modified matrix approach be developed and tested. When the approach proved to produce data within accuracy parameters set by the state, the supervisors further recommended that the approach be approved for planning vocational education.

This does not mean that the supervisors did not recognize limitations to the approach. Probably the most serious limitation in the eyes of the supervisors was the lack of detail in the projections. Projections, while covering the entire labor force, provide detail on only 166 occupations or occupational clusters. This means that many occupations of interest are included in an occupational cluster. With the help of state supervisors, this problem is being worked out.

Presently, 28 additional occupations are broken out of clusters. As an example, agricultural mechanics were grouped under the "Mechanics, Other" cluster. Surveying a sample of Kansas counties with the help of vocational agriculture teachers, it was determined that there was a 1:36 ratio between agricultural mechanics and farmers. Using this ratio, the agriculture mechanics were separated from the "Mechanics, Other" cluster.

State supervisors are responsible for approving vocational programs across the state. One of their primary tools in this task is the demand data produced by this module. New program applications are evaluated on the basis of manpower needs. In addition, established programs with poor placement records are also evaluated using this information. The demand data are never used exclusively in these evaluations since they are most meaningful when combined with supply data to determine net manpower needs. A secondary use of the data is in the Optimum Program Mix module which annually predicts a program mix which is best suited to meet a pre-established goal. (In Kansas, the goal is maximum placement.)

Another use of the data is long-range planning. Each year, the data are used in the Annual Kansas State Plan for Vocational and Technical

Education. The module has not, to this point, directly affected the actions of the state legislature; however, indirectly, the fact that the Kansas State Department of Education has a Management Information System for Vocational Education has affected the attitudes of legislators in a positive manner. For the first time in several years, the Kansas legislature is expected to increase substantially the funds for vocational training.

Operational Description of the Demand Module

Presently, the Demand Module consists of a series of computer programs designed to analyze the Kansas work force in terms of historical trends.

Input and Output[2]

Input data include (1) employment by standard industrial classification code, (2) U. S. Bureau of Labor Statistics matrix factors and ratios, and (3) data designed to modify the matrix in terms of the Kansas situation. The single output is projections of manpower demand by occupation in regions across the state. (See Figure 4 for a sample page of this report.) These data combined with other information are the basis of several other reports, foremost of which is the Annual Demand Supply Interfacing Report. (See Figure 5 for a sample page of this report.)

Non-standard reports are possible by varying the regional definitions or the parameter years used. Boolean searches are possible for various industrial classifications by region. As an example, it is possible to project the manpower needs in the manufacturing industries for a given region. This type of selection is achieved through the restriction of input data.

The input data are either purchased, as in the case of the Bureau of Labor Statistics matrix and Dun and Bradstreet Market Identifiers (R), or provided by other government agencies, as in the case of supplemental employment by standard industrial code data and state-level adjustment factors. It takes approximately one man-month to gather data from the agencies involved. Probably the greatest problem at this time is obtaining approval from the state financial offices to purchase the Dun and Bradstreet Market Identifiers (R) every two years.

All data, with the exception of the Dun and Bradstreet Market Identifiers (R) and the matrix, are entered into the system by punch card. It takes a qualified keypuncher approximately one day to keypunch and verify the data.

As mentioned previously, the cost for a single complete computer run of the total module is $500. The hardware used is an IBM 360 H50

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[2] See Tables 1 and 2.

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Table 1. Input Data

Input	Source of Data	Method of Collection	Method of Entry	Frequency of Collection	Output Report Number and Destination
Data on Firms by SIC by Region (Includes Number of Employees)	Dun and Bradstreet, Inc.	Purchased	Magnetic Tape	Every Two Years (Dun and Bradstreet Updates Tape Every Few Months)	Manpower Needs Report (See Figure Also Used In: Annual Demand-Supply Report Optimum Program Mix Module Evaluation Module
Data on Firms not Covered by Dun and Bradstreet Tape (Including SIC and Number of Employees)	E.S.C., Counsel of Kansas Governments, Liscensing Agencies, Church Associations, etc.	Surveyed by Outside Organizations	Punch Card	Depends on Outside Organization	Same as Above
Replacement Rates for Occupations	Kansas Employment Security Commission	Survey, Analysis, etc. done by the E.S.C.	Punch Card	As E.S.C. has Time (Factors Change Slowly)	Same as Above
U. S. Bureau of Labor Statistics (BLS) Matrix (60-70-80)	U. S. Bureau of Labor Statistics	Purchased	Magnetic Tape	When New Matrix is Released	Same as Above
State Profile Adjustment Factors (Used to Change U. S. Matrix to Kansas Situation)	Kansas Employment Security Comm. Employment by Occupation	Computed Using ESC Estimates	Punch Cards	As ESC Produces Estimates (To Date, this has been every three years	Same as Above
State Expansion Adjustment Factors (Used to Change U. S. Matrix to Kansas Situation	Kansas Employment Security Comm. Expansion by Occupation Estimates	Same as Above	Punch Cards	Same as Above	Same as Above

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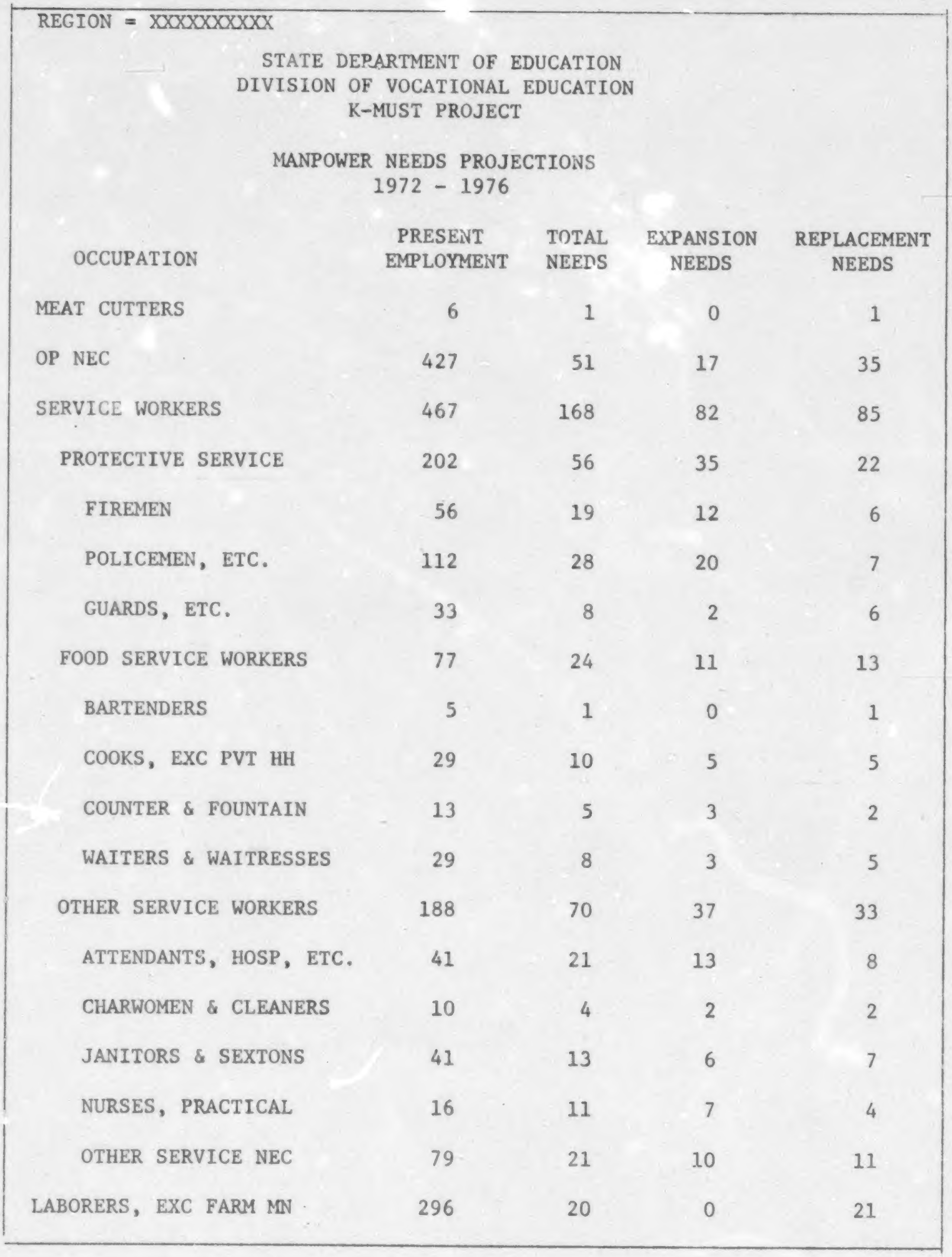
Table 1 (continued)

Input	Source of Data	Method of Collection	Method of Entry	Frequency of Collection	Output Report Number and Destination
Regional Profile Adjustment Factors (Used to Regionalize Matrix)	Kansas Employment Security Comm. Estimates of Employment by County	Computed Using ESC Estimates	Punch Cards	Produced Annually by ESC	Manpower Needs Report (See Figure Also Used In: Annual Demand-Supply Report Optimum Program Mix Module Evaluation Module
Regional Expansion Adjustment Factors (Used to Regionalize Matrix)	Kansas Employment Security Comm. Estimates of Employment by County Changes for Past Ten Years	Same as Above	Punch Cards	Produced Annually by ESC	Same as Above
Parameter Years for Projection Period	Set by State Director	Set by State Director	Punch Cards	As Manpower Needs Report is Required	Same as Above

Table 2. Output Data

Output	Frequency of Report	Organizations and Officers Who Receive Reports on a Regular Basis	Organizations and Officers Requesting Reports
Manpower Demand Projections for State and Eleven Regions	Annually	Division of Vocational Education	
Special Manpower Demand Projections for Selected Regions Industries or Parameter Years	On Request (Given Approval of State Director)	Requesting Organizations	(Planning Units Including City, County, and State Organizations or Local School Districts)



```
REGION = XXXXXXXXXX

                    STATE DEPARTMENT OF EDUCATION
                   DIVISION OF VOCATIONAL EDUCATION
                           K-MUST PROJECT

                    MANPOWER NEEDS PROJECTIONS
                           1972 - 1976

                           PRESENT      TOTAL   EXPANSION   REPLACEMENT
  OCCUPATION              EMPLOYMENT    NEEDS     NEEDS        NEEDS

MEAT CUTTERS                   6           1         0            1

OP NEC                       427          51        17           35

SERVICE WORKERS              467         168        82           85

  PROTECTIVE SERVICE         202          56        35           22

    FIREMEN                   56          19        12            6

    POLICEMEN, ETC.          112          28        20            7

    GUARDS, ETC.              33           8         2            6

  FOOD SERVICE WORKERS        77          24        11           13

    BARTENDERS                 5           1         0            1

    COOKS, EXC PVT HH         29          10         5            5

    COUNTER & FOUNTAIN        13           5         3            2

    WAITERS & WAITRESSES      29           8         3            5

  OTHER SERVICE WORKERS      188          70        37           33

    ATTENDANTS, HOSP, ETC.    41          21        13            8

    CHARWOMEN & CLEANERS      10           4         2            2

    JANITORS & SEXTONS        41          13         6            7

    NURSES, PRACTICAL         16          11         7            4

    OTHER SERVICE NEC         79          21        10           11

LABORERS, EXC FARM MN        296          20         0           21
```

Figure 4. Sample Output Page of KMUST10

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CLUSTERS OF OCCUPATIONS	MANPOWER NEEDS	MANPOWER SUPPLY							NET MANPOWER NEEDS	CLUSTERS OF TRAINING PROGRAMS
		PUBLIC SCHOOLS						PRIVATE SCHOOLS		
		VOCATIONAL-TECHNICAL				NON-VOCATIONAL PUBLIC TRAINING	BUREAU OF APPRENTICESHIP, MANPOWER DEVELOPMENT TRAINING, AND BUREAU OF CORRECTIONS			
		SECONDARY	POST SECONDARY	ADULT PREPARATORY	DELAYED ENTRIES					
OTHER SALESWORKER N.E.C.	10359	251	81		44			244		APPAREL & ACCESSORIES
		115	12		16					AUTOMOBILE
		41	10		6					FLORISTRY
		342	56		51					FOOD DISTRIBUTION
		197	4		27					FOOD SERVICES
		827	399		160			1250		GENERAL MERCHANDISE
		66	106		23					HARDWARE & BUILDING
		22	38		8					HOME FURNISHINGS
										HOTEL & LODGING
		12			1					INTERNATIONAL TRADE
		91	20		13					PERSONAL SERVICES
										RECREATION & TOURISM
TOTAL	10359	1964	726		349			1494	5826	
DELIVERYMEN, CAB	1591	13	6		2				1570	TRANSPORTATION
DENTAL ASSISTANT	696	13	99					150	434	DENTAL ASSISTANT
DENTAL HYGIENIST	291		134						157	DENTAL HYGIENIST
DENTAL LAB TECH	96						2		94	DENTAL LAB TECH
LICENSED PRACTICAL NURSE	2974		1922						1052	LPN TRAINING
MEDICAL ASSISTANT	1587		32					300	1255	MEDICAL ASSISTANT
MEDICAL LAB ASST.	378		24						354	MEDICAL LAB ASST.

Figure 5. Sample Interfacing Page

with five disc drives and two tape drives. Approximately 126 K is required for the software. The Dun and Bradstreet tape and the matrix tape are stored at the Kansas State University Computer Center, while the input cards are stored at the K-MUST offices. Obviously, data storage costs are negligible. The software package is also stored in source deck form at the K-MUST office since compilation costs are less than residence and set-up costs.

With the exception of two minor programs, the entire software package is written in standard American COBOL. Essentially, six of the seven programs in the software package prepare data for the final program. This preparation includes the addition of supplemental employment data to the Dun and Bradstreet data, elimination of unwanted data from the matrix, summarization of employment data by region, and other housekeeping tasks. The heart of the system is KMUST10, which generates the actual projections.

General Discussion and Critique of the Demand Module

At this time, approximately 90 percent of the manpower needs data required by vocational educators in the state can be generated using the modified matrix approach. The remaining ten percent of the data are contained in cluster form in the projections. It is expected that the system will be able to provide break-outs of the remaining clusters within the next year and studies to help with this task are presently being conducted.

Downing and Daniels have conducted studies to verify the accuracy of the technique and have found that error is within acceptable limits. The mean error of profiles found in three Kansas counties was between five and ten percent, with the range of error for significant projections (in terms of size) running from 25 percent to zero percent. In general, it can be said that the larger the projection, the more accurate it is in terms of percentage of error. The State of Kansas feels that this type of error is acceptable for planning when compared with the possible error in data generated by other techniques.

The data generated by the modified matrix approach seem to meet many of the needs of Kansas decision-makers, and it is doubtful that they would accept an alternative technique at this point. Probably the best selling feature is that employment trends are historically based while the few employer surveys conducted in the state indicate a marked change in trends. In summarizing the general attitude, it seems that Kansas decision-makers feel that experience offers better information than the optimism of employers.

The most severe problem with the system is the limited number of occupations projected. As mentioned previously, steps are being taken to overcome this problem. A second problem that has less significance in Kansas is that the matrix has difficulty in identifying emerging occupations since it is historically based. A final problem in that error occurs most frequently in related occupations such as "machinist" and "machine tool operator" can lead to difficulty in breaking out clusters.

The U. S. Bureau of Labor Statistics is presently developing a system of matrices which will include a matrix for every state and every large standard metropolitan statistical area. This new system of matrices will greatly expand the number of occupations projected and should also increase the accuracy of projections. When the Kansas matrix is released, the computer software of the present technique will be rewritten to incorporate the new data.

MANPOWER SUPPLY AND DEMAND DETERMINATION IN MINNESOTA

MELVIN E. JOHNSON

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OVERVIEW OF THE TOTAL MANAGEMENT INFORMATION SYSTEM

Historical Development

The management information system that functions within vocational-technical education in Minnesota evolved as a matter of management need rather than a response to the current popularity of the term. The necessity for information for management decisions was recognized very early at the state administration level due to the rapid development of the system. Minnesota's vocational-technical education system began predominantly at the postsecondary level in the late 1940's and grew to a point at which currently the single system accepts 50 percent of the freshmen (persons pursuing postsecondary education beyond high school). This percentage is equal to one-third of the graduating seniors in the state.

Organization and Design

The Division of Vocational-Technical Education within the State Department of Education is responsible for all aspects of vocational-technical education. The Division is divided into four sections--Program Planning and Development, Program Operations, Program Evaluation, and Manpower Development and Training (Attachment I).

The first three sections mentioned were designed administratively to function similarly to the management of a business or industry. The Program Planning and Development section has responsibility for programmatic development and budgeting on a short- and long-range basis. The Program Operations section then initiates, maintains, and manages the programs. The third section, Evaluation, assesses the appropriateness of the plans and the degree of accomplishment thereof. These three sections take on the functions of planning and budgeting, production or delivery of services, and quality control. The Manpower Development and Training section functions predominantly with the Department of Labor programs.

Information responsibility is divided somewhat differently than the format at this conference. The Program Planning and Development section has responsibility for manpower supply and demand information and determination of resource allocation. Financial accounting and enrollment are responsibilities of the Program Operations section. Student follow-up is a responsibility of the Program Evaluation section.

As you have already heard, the student follow-up system in Minnesota is undoubtedly one of the most sophisticated and successful in existence. Similarly, we believe our student enrollment and financial accounting systems to be equally sophisticated in providing tremendous historically-based information upon which decisions may be made. At the present time the separate subsystems of the management information system are not joined into a single component. While the subsystems are presently functional management information tools, they are independently operated.

Overview of the Subsystem

The third subsystem, which I will now address specifically, is that of supply and manpower demand information. The data produced through manpower analysis information are utilized for making decisions that affect programming and resource allocation. The subsystem is a result of efforts by the Minnesota Department of Manpower Services, the Minnesota Research Coordinating Unit for Vocational Education, and the Minnesota Division of Vocational-Technical Education. Because the efforts are quite independent, it is impossible to determine an actual cost of annual operation. Approximately $10,000 and nine man-months are expended by the Department of Manpower Services to produce the long-range documentation. Several thousand dollars are expended in the annual update of the vocational-technical education component at the Research Coordinating Unit.

Before I get into the specifics of the subsystem, I would like to show you the use made of the product of the system so that you may better understand what we set out to accomplish. Table I of Part II of the State Plan for Vocational-Technical Education asks quite specifically for manpower supply and demand data. A sample of that table from the Minnesota State Plan (Attachment II) shows the detail that we are able to derive within each of the occupational areas wherein training is offered. These data are determined for 151 programs.

The current employment figures are easily drawn from census and tax records. State tax forms in Minnesota require the taxpayer to identify his/her occupation. The projected expansion and replacement needs area is the one I believe to be the most difficult to determine, unless one has a workable crystal ball. Supply data have been generally accurate in the categories of concern, but the demand data have too often been in error.

Objectives

Therefore, within a project at the Minnesota Research Coordinating Unit, an occupational demand information system was developed. There were two basic objectives in its development. One was to establish occupational demand, and the other was to determine unfilled positions. The major portion of my presentation and paper is from a publication by the Minnesota Research Coordinating Unit for Vocational Education at the University of Minnesota. The publication was extremely limited as it was produced mainly for program planning purposes at the state level. Credit must be given to George Copa, who was the prime author of this work; through his efforts we believe the system to be extremely useful.

For purposes of the system, occupational demand is defined as the total number of employment positions in a geographic area. The output data are available on a statewide basis and metropolitan-area basis as well as by economic region, the state being divided into 11 such regions (Attachment III). Thus, we can describe within a given area the scope or size of an occupation in terms of total number of positions.

A second area of concern--unfilled positions--is defined as the number of positions which are to be newly filled within a prescribed period of time. More precisely, then, unfilled positions are the number of new employees needed during a time period. Fortunately, within the State of Minnesota the Department of Manpower Services periodically estimates the total occupational demand. The estimates are made from the projected industrial growth in the state, the projected staffing of industries in the nation, and the census data on occupational and industrial categories of jobs held by the population in Minnesota. Our present estimate is a projection comparing occupational demand in 1968 and 1975. The publication, 1975 Employment, Minnesota and Minneapolis-St. Paul Metropolitan Area and 11 Economic Regions,[1] is one that I would recommend as an excellent resource for anyone involved in deriving demand information. The Department of Manpower Services is currently redoing the publication, establishing a data base from 1973 to 1980.

The estimation of unfilled positions in each specific occupation is derived by observing two major factors. The first is the average growth or decline in occupational demand for the given occupation. Growth is the addition of new positions, while decline is the elimination of existing positions. The second factor is the annual replacement of workers who die, retire, or withdraw from the labor force. By utilizing these two factors and a single year as the time period, occupational demand within a specific occupation can be defined as the number of positions in the occupation last year plus the average annual growth or decline in positions. Similarly, unfilled positions in the occupation can be defined as the average annual growth or decline in positions plus the annual number of positions which were vacated because of death, retirement, or worker withdrawal.

Operational Description of the Subsystem

I will now explain the method utilized in estimating occupational demand and unfilled positions within a given year. As an example, I will use the nine broadest occupational categories in the state of Minnesota to show how calculations were made. Occupational demand for 1973 is the first estimate which will be described. It is derived by using data from the previously mentioned Department of Manpower Services publication which provides demand estimates for 1968 and 1975 using a linear projection. The average growth or decline for the year is estimated by subtracting the number of positions for 1968 from the number of positions in 1975 and dividing by seven. Attachment IV shows the table with annual growth or decline within the occupational categories. The estimated figures given are in slight error because of rounding errors when compared with the annual growth or decline calculated in each of the areas within the broad occupational area.

---

[1] 1975 Employment, Minnesota and Minneapolis-St. Paul Metropolitan Area and 11 Economic Regions, Minnesota Department of Manpower Services, St. Paul, Minnesota, January, 1970.

In making the calculation it was assumed that occupational demand grows or declines by a constant annual rate. This means that we are looking only at general trends in occupational demand without attempting to take year-to-year changes in the national, state, and local economies into consideration. Occupational demand for 1972 was calculated by multiplying the average annual growth or decline by four and adding this to the estimated 1968 demand. Attachment V shows the results that would be derived for 1973. These can be updated each year in a very simple manner.

The second factor to be calculated is unfilled positions, which is the sum of annual growth or decline in demand plus the annual number of positions to be replaced because of vacated workers. Number of annual replacement positions is derived by multiplying a replacement percentage by the occupational demand in the last time period, 1972 in this case.

Replacement percentages will vary not only between occupations but by the sex of the employee. The calculation of replacement rates necessitates first estimating the number of males and females in the occupation. The percentages of males and females are derived from the census of population. Where rates for occupations did not exist, the next broadest category was utilized as an estimator. Attachment VI shows the estimated distribution of males and females in the nine broadest categories. When utilizing these census data, one must assume that this distribution is a constant. The validity of this assumption has been checked by comparing 1960 and 1970 census figures. The largest deviation during this period of time for Minnesota in the nine broadest categories was 11 percentage points for clerical and craftsmen. The average deviation in male/female percentages was 4.1. Knowing the number of males and females in each occupation, the number of replacements can be calculated by multiplying the number of persons of a given sex in an occupation by the replacement rate for that sex and occupation.

Attachment VII shows the resultant calculations. For example, the 140,945 male professionals are multiplied by the 1.6 replacement rate, resulting in an annual number of replacements needed of 2,255. With the addition of the needed females, we have a total number of replacements estimated at 6,495. When all segments of the professional categories are used, an estimated replacement rate of 7,054 is derived. This discrepancy again is caused by rounding errors within the program. The replacement rates are derived from the U. S. Department of Labor, with the exception of the farm categories. The rates are derived on labor force participation rate and age distribution of employees in the occupation. Vacated positions because of death, retirement, or mobility are included in the replacement rates.

The unfilled positions are then calculated by adding the annual growth and decline from Attachment IV and the annual replacements in Attachment VII. This calculation makes two assumptions. The first is that all persons who die, retire, or leave the labor force vacate a position which will again be filled. Second, it assumes that when growth or decline is negative, the employees losing their jobs will have first priority on unfilled replacement positions. For example, persons in the occupation of farmer are self-employed, and, when they go out of business for reasons other than specified under annual replacement, they do not usually buy another farm. With these assumptions in force, unfilled positions for each of the nine broadest occupational categories are shown in Attachment VIII.

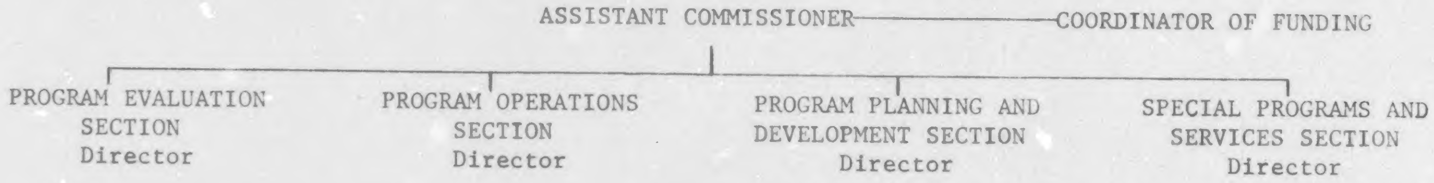
The program format is shown in Attachment IX for 1973. This represents the actual output from the computer. As shown, the broad category of craftsmen has a subcategory of construction crafts made up of ten occupational subcategories. The entire program specifies 151 such subcategories. Moving across, the occupational demand column represents an estimate of the number of the total employment positions in a given geographic area. As earlier indicated, this might be the entire state or a portion thereof. The second and third numerical columns contain the estimates of annual growth or decline in positions and the annual number of positions to be replaced because persons vacated positions. The fourth column contains the estimate of unfilled positions for 1973. Again, this is the sum of annual growth or decline and annual replacements from columns two and three. The last column contains a percentage figure of total unfilled positions represented by the unfilled positions in the specific occupation. For example, craftsmen make up 11.2 percent of the total estimated unfilled positions of 66,025, which is the sum of all occupational groups in the state. Similarly, construction crafts make up 2.05 percent of the 11.2 percent, and carpenters are .54 percent of the 2.05 percent. The percentage figure is extremely helpful in comparison to the percentage figures derived when one observes supply data from training programs. I must caution you that when interpreting the information, we constantly keep in mind that these are estimated, based on a number of assumptions and limitations. I have pointed out most of these where appropriate. An additional assumption is that, in calculating the number of replacements for a given occupation in an economic region, the percentage distribution between males and females and the replacement rate for males and females are assumed to be the same as for the total state. The system as described is purely a mathematical program that is not impacted by short-range changes in economic needs or the geographic mobility of employers, and, naturally, the validity decreases as the geographic area decreases. We believe its validity to be greatest at the state level. We have made no attempt to determine the exact amount of error that might exist. However, in several instances while validating the need for initiating a proposed new program, extensive research has gone into determining demand and unfilled positions in a specific occupation through direct contact with employers, employees, and unions. In later comparisons, the estimators derived from this program have been accurate within five percent.

General Discussion and Critique of the Subsystem

Since the planning of vocational-technical education programs rarely necessitates decisions about whether or not to drop all programs, but rather what marginal changes should be made, it has not been critical to obtain supply data outside of the vocational-technical education system. The Minnesota Division of Vocational-Technical Education has complete output records on the graduates. It also has statutory authority over private trade schools, such that their output is also available to complete the major portion of the labor supply information. However, because Minnesota is presently at the point where we may overfill many occupations, we have requested that the Research Coordinating Unit develop a similar model for the derivation of labor supply that includes the mobility of individuals between occupations. This model has been developed by Dr. Copa and Mr. Don Irvin and will be published within the next few weeks. The publication also attempts to combine mathematically supply and demand information. I am sure it will be of utmost interest to all persons involved in management decisions.

ATTACHMENT I

Department of Education
DIVISION OF VOCATIONAL-TECHNICAL EDUCATION
Organization Chart



ASSISTANT COMMISSIONER — COORDINATOR OF FUNDING

PROGRAM EVALUATION SECTION
Director

PROGRAM OPERATIONS SECTION
Director

PROGRAM PLANNING AND DEVELOPMENT SECTION
Director

SPECIAL PROGRAMS AND SERVICES SECTION
Director

Table 1. Employment Opportunities Related to Vocational Education Programs: Labor Demand and Supply Summary

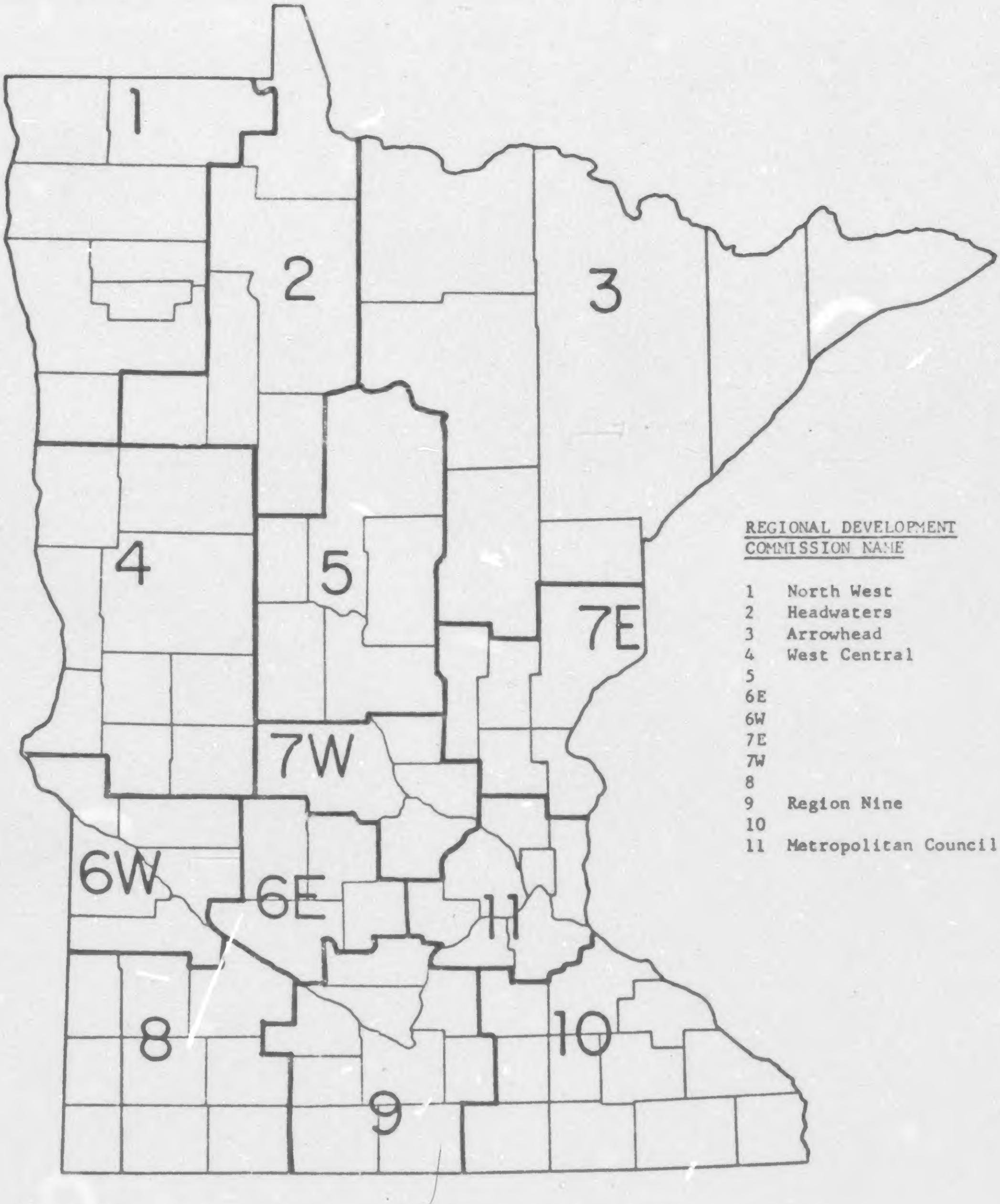
Program: 01. Agriculture

Fiscal Year Ending: June 30, 1974

O.E. CODE	INSTRUCTIONAL PROGRAM	CURRENT EMPLOYMENT	PROJECTED EXPANSION & REPLACEMENT NEEDS		PROJECTED LABOR SUPPLY			
					VOCATIONAL EDUCATION OUTPUT		OTHER SECTORS OUTPUT	
			1974	1978	1974	1978	1974	1978
.0000	Total Agriculture	242,989	6,245	7,501	3,706	4,501	410	705
.0100	Agricultural Production	116,924	880	764	695	560	40	50
.0200	Agricultural Supplies/Services	42,118	1,892	2,320	957	1,312	200	300
.0300	Agricultural Mechanics	24,305	1,602	2,130	1,124	1,501	50	70
.0400	Agricultural Products	48,538	1,285	1,505	173	210	50	70
.0500	Ornamental Horticulture	2,111	404	580	268	325	40	50
.0600	Agricultural Resources	5,856	118	130	320	388	15	150
.0700	Forestry	3,137	64	72	169	205	15	15
.9900	Other							

MINNESOTA DEVELOPMENT REGIONS

ATTACHMENT III



REGIONAL DEVELOPMENT COMMISSION NAME

1	North West
2	Headwaters
3	Arrowhead
4	West Central
5	
6E	
6W	
7E	
7W	
8	
9	Region Nine
10	
11	Metropolitan Council

State Planning Agency/Office of Local & Urban Affairs

ATTACHMENT IV

MINNESOTA ANNUAL GROWTH OR DECLINE IN OCCUPATIONAL DEMAND

OCCUPATION	1968 DEMAND	1975 DEMAND	ANNUAL GROWTH OR DECLINE
PROFESSIONAL	213,304	256,469	6,148
MANAGERS	125,066	135,596	1,504
CLERICAL	231,120	271,466	5,758
SALES	111,359	122,202	1,549
CRAFTSMEN	193,052	218,035	3,561
OPERATIVES	228,543	259,004	4,348
SERVICE	180,768	208,162	3,909
FARMERS AND FARM WORKERS	132,696	102,226	-4,352
LABORERS (EXC. FARM & MINE)	50,708	49,228	- 211

ATTACHMENT V

MINNESOTA OCCUPATIONAL DEMAND 1973

OCCUPATION	1972 DEMAND	ANNUAL GROWTH OR DECLINE	1973 DEMAND
PROFESSIONAL	238,899	6,148	245,047
MANAGERS	131,082	1,504	132,586
CLERICAL	254,152	5,758	259,910
SALES	117,555	1,549	119,104
CRAFTSMEN	207,296	3,561	210,857
OPERATIVES	245,935	4,348	250,283
SERVICE	196,404	3,909	200,313
FARMERS AND FARM WORKERS	115,288	-4,352	110,936
LABORERS (EXC. FARM & MINE)	49,864	- 211	49,653

ATTACHMENT VI

PERCENTAGE AND NUMBER OF MALES AND FEMALES IN 1972 OCCUPATIONAL DEMAND FOR MINNESOTA

OCCUPATION	1972 DEMAND	PERCENT MALE	NUMBER MALE	PERCENT FEMALE	NUMBER FEMALE
PROFESSIONAL	238,889	59	140,945	41	97,944
MANAGERS	131,082	87	114,041	13	17,041
CLERICAL	254,152	32	81,329	68	172,823
SALES	117,555	63	74,060	37	43,495
CRAFTSMEN	207,296	97	201,077	3	6,219
OPERATIVES	245,935	77	189,370	23	56,565
SERVICE	196,404	32	62,849	68	133,555
FARMERS AND FARM WORKERS	115,288	92	106,065	8	9,223
LABORERS (EXC. FARM & MINE)	49,864	97	48,368	3	1,496

ATTACHMENT VII

MINNESOTA REPLACEMENT RATES AND NUMBERS BY SEX AND OCCUPATION, 1973

Occupation	Total Male	Male Replacement Rate	Number of Male Replacements	Total Female	Female Replacement Rate	Number of Female Replacements	Total Number of Replacements
PROFESSIONAL	140,945	1.6	2,255	97,944	4.9	4,799	6,495
MANAGER	114,041	2.5	2,851	17,041	4.7	801	3,136
CLERICAL	81,329	1.8	1,464	172,823	4.9	8,468	10,140
SALES	74,060	2.0	1,481	43,495	4.7	2,044	3,525
CRAFTSMEN	201,077	1.9	3,820	6,219	4.3	267	3,836
OPERATIVES	189,370	1.5	2,841	56,565	4.1	2,319	4,857
SERVICE	62,849	2.7	1,697	133,555	4.7	6,277	7,885
FARMERS AND FARM WORKERS	106,065	2.6	2,758	9,223	2.6	240	3,045
LABORERS (EXC. FARM & MINE)	48,368	1.7	822	1,496	4.7	70	892

MINNESOTA UNFILLED POSITIONS IN 1973

OCCUPATION	ANNUAL GROWTH OR DECLINE	ANNUAL REPLACEMENTS	UNFILLED POSITIONS
PROFESSIONAL	6,148	6,495	12,643
MANAGER	1,504	3,136	4,640
CLERICAL	5,758	10,140	15,898
SALES	1,549	3,525	5,074
CRAFTSMEN	3,561	3,836	7,397
OPERATIVES	4,348	4,857	9,205
SERVICE	3,909	7,885	11,794
FARMERS AND FARM WORKERS	-4,352	3,045	- 1,307
LABORERS (EXC. FARM & MINE)	- 211	892	681

ATTACHMENT IX

MINNESOTA ANNUAL OCCUPATIONAL DEMAND FOR 1973

Occupation	1973 Demand	Annual Growth or Decline	Annual Replacement	1973 Unfilled Positions	Percent of Total Unfilled Positions
Craftsmen	210,857	3,561	3,836	7,397	11.20
Construction Crafts	50,176	380	974	1,354	2.05
Carpenters	16,369	- 18	376	358	0.54
Brickmasons & Tile Setters	3,693	29	54	83	0.13
Cement, Concrete Finishers	987	24	14	38	0.06
Electricians	7,028	91	110	201	0.30
Excavating, Grading Machine Operators	5,268	88	67	155	0.23
Painters & Paper Hangers	6,607	- 16	171	155	0.23
Plasters	1,061	6	18	24	0.04
Plumbers & Pipefitters	7,292	134	128	262	0.40
Roofers & Slaters	820	12	16	28	0.04
Structural Metal Workers	1,051	30	20	50	0.08

OCCUPATIONAL TRAINING INFORMATION SYSTEM
(OTIS)

J. B. MORTON

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OVERVIEW OF THE TOTAL MANAGEMENT INFORMATION SYSTEM

Historical Development

The Management Information System in Oklahoma has undergone a great deal of development and refinement in recent years. The financial system has been in existence longer than any other system in Oklahoma. The early financial records were kept by the pen and ink system. In 1968, Oklahoma moved toward computerizing its system. Also in 1968, with attempts to develop the Occupational Training Information System which included the Student Accounting System, the present Management Information System began its evolution to its present form. In 1970, the Research Coordinating Unit (RCU) was made a part of the Oklahoma State Department of Vocational and Technical Education and became known as the Division of Research, Planning, and Evaluation (RP&E). Other systems have been added to give the administration information that the State Department needs to make management decisions.

Organization and Design

The State Department is organized in such a way that change can be made quicker and easier than it can in some states because of the structure of its organization. The State Department is a separate agency in the State of Oklahoma. The organizational structure of the State Department is shown in Figure 1. It indicates that there is a Director, Francis Tuttle, and a Deputy Director, Arch Alexander, who has the responsibilities for administrative decisions which include special schools, public information, and curriculum and instructional materials development. Under the Director and Deputy Director, there are three separate assistant directors with specific responsibilities. Byrle Killian, Assistant State Director for the Educational Services and Special Programs, is responsible for all of the regular educational programs in the secondary, postsecondary, and adult teaching areas. William Stevenson has as his responsibilities the Research, Planning, and Evaluation Division, which includes research, planning, evaluation, information services, and special projects. Larry Hansen is the assistant director in charge of the Business, Finance, and Purchasing area. This includes the accounting for all inputs and expenditures of all invoices, facilities and equipment, purchasing, and the equipment pool. The organizational structure of the total Management Information System falls within these three areas of responsibility.

Research, Planning, and Evaluation has the responsibility for most of the Management Information System in that it has the responsibility for the Student Accounting System, Occupational Training Information System (OTIS), the Teacher Information System, Evaluation, and population information. Finance has the responsibility for the financial system and facilities and equipment. The supportive and administrative services have the responsibility for curriculum development.

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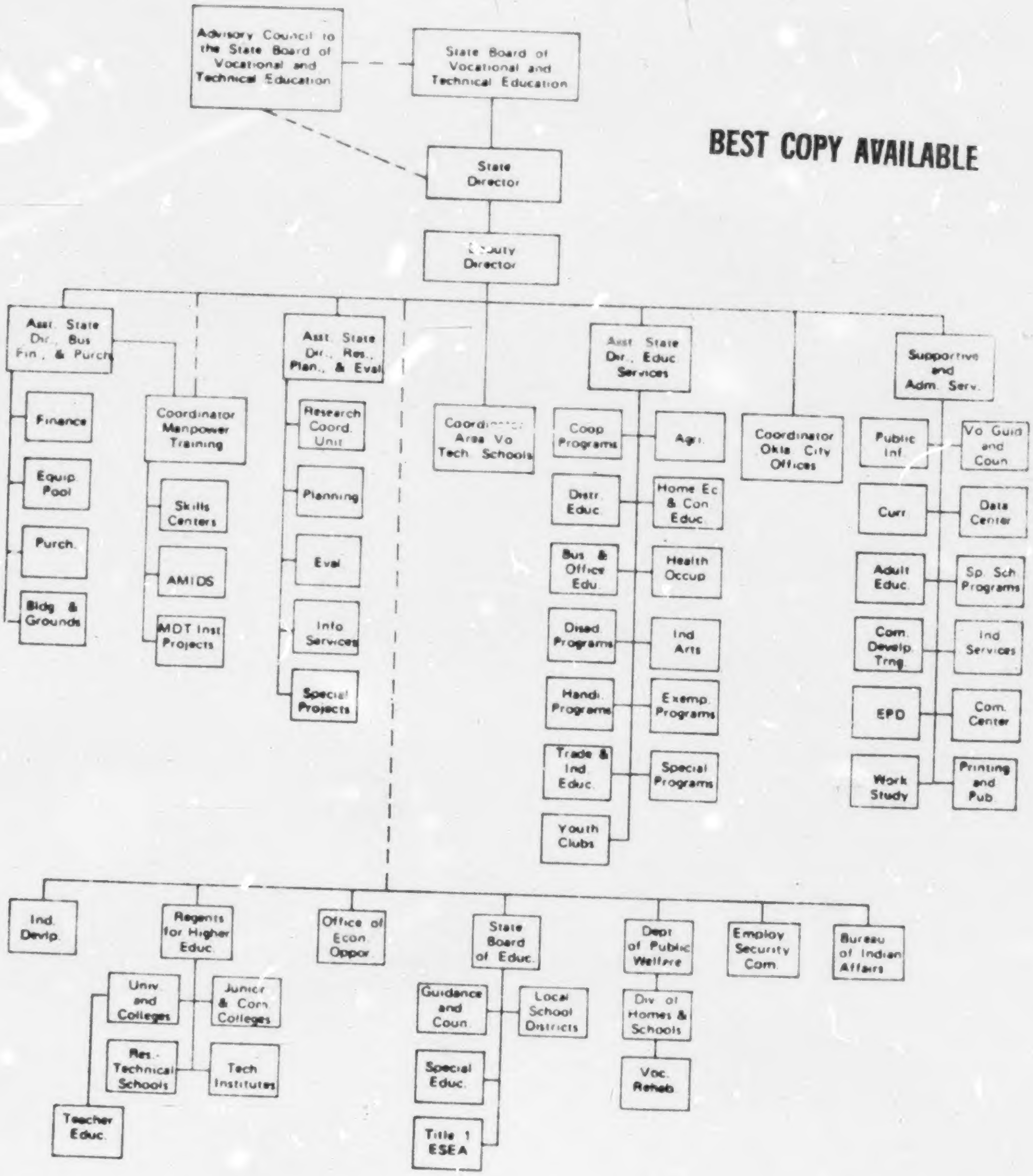

Figure 1. Organizational Chart for State Department of Vocational and Technical Education

Oklahoma's Management Information System chart is shown in Figure 2. Below is an explanation of the components of this chart.

Student Accounting System. The Student Accounting System is an annual entry of individual students (secondary, postsecondary, and adult) in vocational and technical education. It contains information concerning enrollment, completion, and first-, third-, and fifth-year follow-up.

Curriculum Development. Curriculum is developed on performance objectives for vocational-technical programs for about 60 percent of the teaching time. All materials are coordinated with the teachers, industry, supervisors, and teacher-educators. Teaching materials have been developed to cover 67.5% of the secondary vocational students enrolled. This material is used at all levels of vocational-technical education. Special materials are developed for some adult classes.

Teacher Information System. Information for this subsystem originates from existing systems in the State Department of Education, the State Teacher Retirement System, and Teacher Certification.

Facilities and Equipment. All facilities and equipment purchased from federal or state (other than district) money and equipment obtained from the U. S. surplus and excess properties are computerized to make annual inventory checks with the school districts in the state. All expenditures are computerized for administrative use.

Evaluation. Oklahoma is committed to provide an on-site evaluation of 20 percent of the secondary programs annually. The evaluation results in a product index for each program. This product index makes supervisors and administrators aware of the value of the programs to society.

Population. The population includes all of the information that can be compiled on the population in Oklahoma.

Overview of the Occupational Training Information System

It became apparent in Oklahoma that if existing manpower training and related agencies were to make their maximum contribution to the development of human resources, intensive efforts would have to be made in the direction of statewide manpower planning. The recognition of the need for statewide manpower planning is manifested in federal and state legislation and in the establishment of coordinating committees and commissions in Oklahoma and in the nation. However, the need remained for the development and demonstration of an effective information system and related procedures for implementing statewide manpower planning. In Oklahoma, two studies were completed in 1967 which explored the need for statewide manpower planning. One was done by Ling-Temco-Vought System Management Service and the other by Oklahoma State University. These

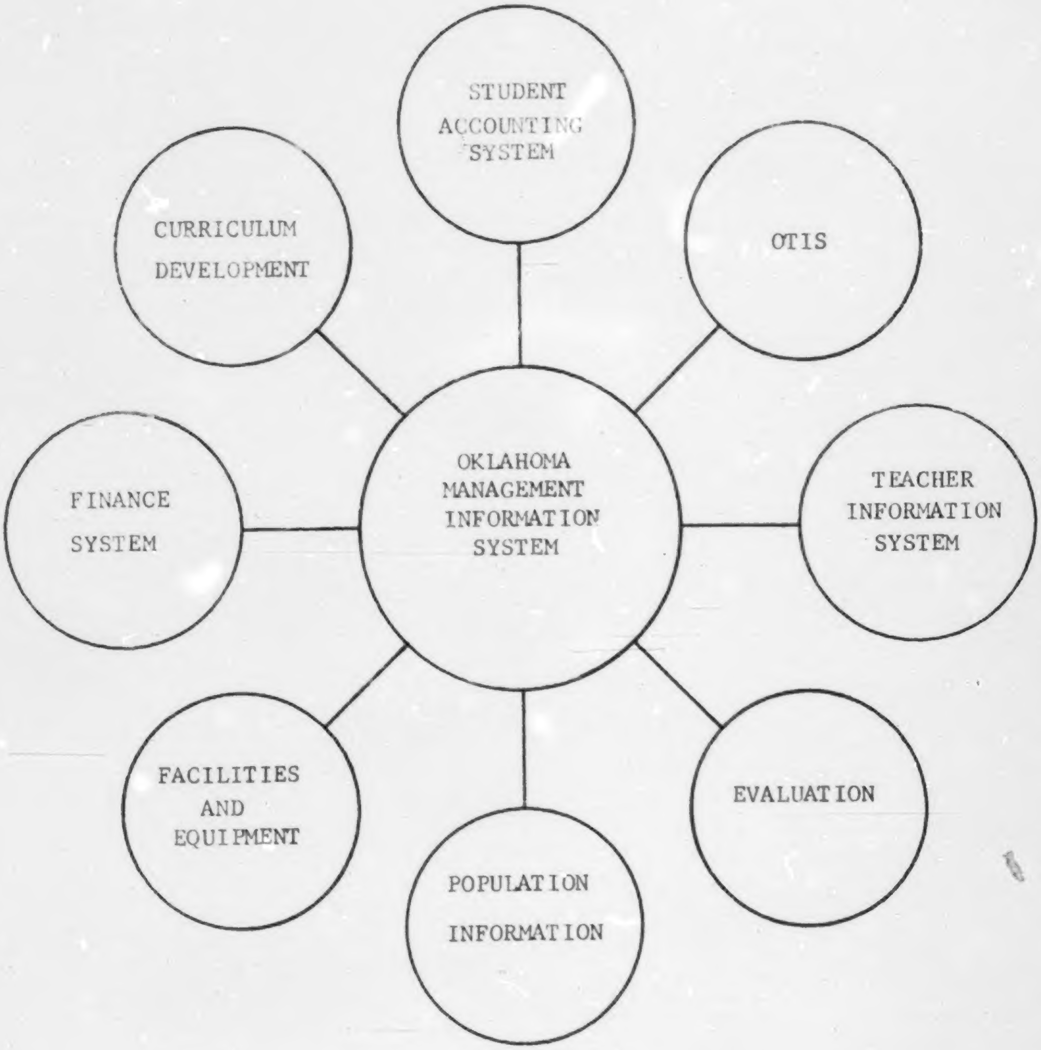

Figure 2. Oklahoma Management Information System

studies were oriented toward identifying the actions and sequential steps necessary for the establishment of a flexible occupational training system that could provide skilled manpower to satisfy the state's present and future demands. One of the principal recommendations made was the establishment of a system to provide continuing detailed information for policy and operational decisions on a statewide basis.

This recommendation was based primarily on the following needs:

1. Introduction of a systematic and continuous demonstration and evaluation to replace a history of sporadic and isolated research activity.

2. Development of inter-agency cooperation, coordination, and commitment based on the premise of greater return to all.

3. Establishment of new data linkages to replace inadequate information-gathering and processing utilized for some manpower policy decisions.

4. Statement of objective criteria and guidelines for assessing the relevance of vocational-technical programs to replace objective standards wherever possible.

In the spring of 1968, representatives from the Research Department of the Industrial Development and Parks Department, the State Department of Vocational and Technical Education, and the Oklahoma Employment Security Commission met to discuss the needs for a statewide research and demonstration project. This project would bring maximum resources to bear on implementing the strategy for economic development which had as its major premise the development of a skilled labor force. Subsequently, the Manpower Research and Training Center at Oklahoma State University was approached to react in detail to the feasibility of such a project. In July of 1968, a proposal was submitted to the concerned agencies, whereupon the State Department of Vocational and Technical Education and the Industrial Development and Park Department agreed to preliminary funding of the project. Cooperation was provided by the Oklahoma Employment Security Commission and the Association of Private Schools.

After the publication of OTIS Cycle One, it was decided there were agencies that were interested in the publication other than the organizations listed above. It was, therefore, decided that the OTIS advisory committee should be established. All of the organizations represented on the advisory committee have had input into the OTIS publication. The people on the advisory committee are familiar with the procedure for gathering the demand and supply input and how each of these is treated in coming up with net demand information for the occupations listed in OTIS. Theretore, each of the organizations on the OTIS advisory committee has had input into the design of OTIS. The OTIS advisory committee meets each year before the publication is made public and approves or disapproves each item in the publication.

Objective

The objective of OTIS is to develop and initiate a systematic, continuous, and detailed system to provide manpower data by occupation to the administration of the State Department of Vocational and Technical Education. This information is provided so that decisions may be made on program planning in order to bring about a proper balance between manpower needs and manpower training.

Relationship of Occupational Training Information System to Decision-Makers

Some of the organizations and agencies that are using OTIS to make decisions are as follows: The State Department of Vocational and Technical Education, Governor's Comprehensive Manpower Planning, Southern Oklahoma Development Association, Oklahoma Employment Security Commission, Oklahoma Health Planning Commission, Oklahoma Economic Development Association, Oklahoma State Office of Community Affairs and Planning, Oklahoma State University Research Foundation, Association of Central Oklahoma Government, Oklahoma Council of Health Careers, Kiamichi Economic Development District, Northern Oklahoma Development Association, State Accrediting Agency, Indian Nation Council of Governments, Central Oklahoma Economic Development Association, Tulsa, Oklahoma City, and smaller cities Chambers of Commerce, Southwest Oklahoma Development Association, Oklahoma State University, Association of South Central Oklahoma Governments, Advisory Council for Vocational-Technical Education, Ozark's Regional Commission, Association of Private Schools, Eastern Oklahoma Development District, Eleven Area Health Planning Organizations, Oklahoma State Regents for Higher Education, Manpower Development Training, Bureau of Indian Affairs, Rehabilitation Services, Department of Corrections, Work Incentive Program, Opportunities Industrialization Center, most of the local school districts and the State Legislators.

Operational Description of Occupational Training Information System

The organizations that have made financial contributions to the development of OTIS have been the Manpower Administration, the U. S. Department of Labor, on a specially funded program of $99,390; the Ozarks Regional Commission, which gave $40,000; and the Oklahoma Industrial Development and Parks Department, with a contribution of $34,863. Staff released time from the State Department of Vocational and Technical Education and other agencies such as Oklahoma Employment Security Commission and the Private School Association would bring the total estimated development costs to about $200,000.

The Information Services Unit of the Division of Research, Planning, and Evaluation has the responsibility for the OTIS system. The

Division of Research, Planning, and Evaluation is funded under the regular budget of the State Department of Vocational and Technical Education monies coming from both state and federal levels. The annual operating cost of the OTIS system is as follows:

	Annual Cost
Demand Sector, four years at $40,000	$ 10,000
Supply Sector	
Student Accounting System annual cost $14,293, 20 percent of this time designated for OTIS	3,022
Programming and Collection of Data	3,000
Administration	3,000
Computer Time 5 hours @ $35	175
Travel	567
Cost of Publication (2,500 copies)	2,500
Grand Total	$ 22,264

The cost of the clerical staff, part-time staff, and teaching staff needed for the publication of OTIS is not budgeted for by the State Department of Vocational and Technical Education. Table 1 on the following page does give a break down of the budgeted cost of the OTIS publication.

Input

The content of OTIS is summarized into two main tables, the Net Additional Manpower Requirements Table and a Descending Ordering of Program Clusters table. Appendix C is an example taken from Net Additional Manpower Requirements Table, Statewide Totals in the OTIS publication.

The Net Additional Manpower Requirements Table utilizes the clustering of related occupations which are matched with programs that train workers for those occupations. A cluster may contain one or more occupations and one or more types of programs. The occupations are identified by Dictionary of Occupational Titles codes, and the programs are identified by U. S. Office of Education code (example: Agriculture 010100, 010200, 010400; Distributive Education 041300, 041700; etc.). These clusters are also numbered.

To determine the net manpower requirements in a cluster, the total of the supply (registrants and students who have completed the training programs and are available to the labor market) is subtracted from the demand (job openings). Where demand exceeds supply, the net manpower requirement is positive; where the demand is less than the supply, the net manpower requirement is negative. The negative numbers are indicated in the tables by the negative sign (-).

Appendix D is an example taken from the OTIS Descending Rank Order of programs. In this table a descending rank order of program clusters by statewide net manpower demand is presented. The program

Table 1. Resource Requirements

Operation	Personnel			Hardware	Software
	Number	Time	Estimated Cost		
Data Collection				Model 29 IBM Keypunch	None
Student Acct. System	1	.5 mo.	$900/mo.		
Private Schools	1	.075 mo.	$900/mo.		
MDTA	1	.15 mo.	$900/mo.		
Other Federal	2	1 mo.	$1,800/mo.		
OESC	15 part-time	12 weeks/year	$40,000 for 4 years		
State Regents for Higher Education	2	1.5 mo.	$1,800/mo.		
Data Processing	2	.5 mo.	$1,350/mo.	UNIVAC Spectra 70, Printer, tapes, cards, disk	42K
Data Storage	2	.5 mo.	$1,350/mo.	UNIVAC Spectra 70, tapes, cards, disk	
Data Display	2	.5 mo.	$1,350/mo.	UNIVAC Spectra 70, cards, printer	

cluster with the greatest net manpower demand is ranked one (1) and is followed in order by the program clusters with lesser demand.

It must be remembered that the net manpower demand figures are only projections and are not, therefore, absolute values to be taken literally. Comparison of the ranks of specific clusters must be accompanied by an examination of the difference in net manpower demand between the clusters.

The rank ordering is provided as a simple analysis of the tables. It may be used to identify quickly program clusters by vocational and technical divisions in which training is needed on a statewide and/or regional basis.

The occupations listed in OTIS have varied slightly over the years depending upon the needs of the State Department of Vocational and Technical Education and the availability of the demand information from the Oklahoma Employment Security Commission. Each year, requests are made to the state supervisors to see if there is additional occupational information needed. The Oklahoma Employment Security Commission provides input to the availability of the information as well as the OTIS advisory committee. All of these inputs are used to decide on the occupations that are listed in OTIS. The State Department of Vocational and Technical Education provides the money for the continuing output of OTIS; therefore, we are concerned about the occupations that vocational and technical education trains for.

The State Department of Vocational and Technical Education is responsible for the collection of the supply data used as input for OTIS. Table 2 on the following page shows the type of input data, the source of the input data, the method of collecting the data, the method of entry of the data into the programming system, the frequency of collection of the input data, and the number of output reports. The table also indicates that all of the demand information comes from the Oklahoma Employment Security Commission, the method of collecting the demand data, the method of entry of the data into the programming system, and the frequency of collection of the demand data.

The primary data on manpower demand utilized in OTIS are developed by the Oklahoma Employment Security Commission (OESC) based upon a survey conducted during 1971 with an original sample of 2,633 firms. The firm listing included firms covered by the unemployment insurance laws and was augmented by a mixture of the larger non-covered establishments such as government agencies, hospitals, and other non-profit organizations. These firms were listed by industrial divisions in descending order by employment size. All of the establishments comprising the upper 50 percent of the industry's employment total were included in the survey. Of the remaining firms in the industry, 20 percent and 5 percent samples were selected from the third and fourth quartiles, respectively. During June of 1971, questionnaires, job descriptions, and instructions were mailed to the surveyed firms. For the next two months, personal visits were made to the state's largest employers to

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Table 2. Input Data

Input	Source of Data	Method of Collection	Method of Entry	Frequency of Collection	Output Report Number and Destination
Supply					
State Department (Secondary, Post Secondary, Adult)	Student Accounting System	Computer Tape	Computer Tape	Computer Tape	OTIS 2500 copies
Private Schools	Accrediting Agencies	Agency Files	Cards	Annually	
MDTA	Manpower Development Training	Agency Files	Cards	Annually	
Other Federal	Governor's Manpower Commission	Survey of other agencies	Cards	Annually	
Oklahoma Employment Security Commission Registrants	Oklahoma Employment Security Commission	Survey	Cards	Annually	
State Regents	State Regents	Survey	Cards	Annually	
Demand	Oklahoma Employment	Firm Survey	Cards	Annually	

solicit their cooperation. The OESC was able to survey 83.8 percent of the employment in the areas surveyed.

For the OTIS the data base was updated by the Research and Planning Division of OESC. Basically, the update consisted of reviewing the larger firms' employment changes. These were analyzed to see if they were following the previously projected trend. Those establishments that varied from their forecast were contacted by OESC personnel to confirm the change and secure new projections. Furthermore, all newly established large firms were visited by OESC personnel to get employment information. These data were then incorporated into the data base and used to update the demand information.

The 1973 survey of health occupations which was conducted by the OESC in conjunction with the Oklahoma State Department of Vocational and Technical Education was used to supplement the demand information. This survey sampled employers in the health occupations, such as hospitals, nursing homes, government agencies, and private practice. The OESC combined all of the data from the agencies above and edited them in terms of known economic conditions to produce the figures interfaced in the manpower demand column of the tables.

Other manpower demand information has been developed by Jesse B. Mitchell, "Employment Opportunities and Educational Needs in Off-Farm Agri-Business Occupations in Oklahoma," State Department of Vocational and Technical Education, September, 1971, and by the Oklahoma State University Agricultural Economics Department's Farm Manpower projections.

The State Department has an established procedure for approving new programs. New occupational training program requests will be approved only in areas of manpower demand specified in the State Plan as indicated by OTIS or in areas where a significant demand is indicated by valid local surveys. The occupational and training program needs for the State Plan will be derived from OTIS and furnished by the Division of Research, Planning, and Evaluation. The local survey information will be validated by the Division of Research, Planning, and Evaluation if the survey accompanies a program request from the local level. The procedure and the sequential steps for program approval may be found in Appendix A.

Output[1]

OTIS is used by the state directors and district supervisors to emphasize the need for the various training programs and to change the emphasis and direction of particular programs which are not meeting the demand need. The material is used with state and federal legislators to indicate to them the number of people enrolled, the number of people who are getting jobs, and the number of people whom we need to train for these jobs. An example of this usage is in the health area where a great deal of federal money has gone into planning on the state, regional, and county level. We have used the OTIS concept in doing special health training publications and have just completed a publication, Oklahoma Health Manpower Needs 1973-1974.

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[1] See Table 3.

Table 3. Output Data

Output	Frequency of Report	Organizations and Officers Who Receive Reports on a Regular Basis	Organizations and Officers Requesting Reports
2500 copies of OTIS	January 15 each year spanning the fiscal year	The State Department of Vocational and Technical Ed. Governor's Comprehensive Manpower Planning Southern Oklahoma Development Association Oklahoma Employment Security Oklahoma Health Planning Commission Oklahoma Economic Development Association Oklahoma State Office of Community Affairs and Planning Oklahoma State University Research Foundation Association of Central Oklahoma Government Oklahoma Council of Health Careers Kiamichi Economic Development District Northern Oklahoma Development Association State Accrediting Agency Indian Nation Council of Governments Central Oklahoma Economic Development Association	The State Department of Vocational and Technical Ed. Governor's Comprehensive Manpower Planning Southern Oklahoma Development Association Oklahoma Employment Security Oklahoma Health Planning Commission Oklahoma Economic Development Association Oklahoma State Office of Community Affairs and Planning Oklahoma State University Research Foundation Association of Central Oklahoma Government Oklahoma Council of Health Careers Kiamichi Economic Development District Northern Oklahoma Development Association State Accrediting Agency Indian Nation Council of Governements Central Oklahoma Economic Development Association

We use the OTIS information with out VIEW Project and also make wide distribution of the OTIS publications to the superintendents, principals, and counselors in the state of Oklahoma. The OTIS project is used by city, county, and area planners when they need to know the number of people who are available for employment in the various occupations. The information is also used in the public relations area in order that the people in Oklahoma will become familiar with what the State Department of Vocational and Technical Education is doing, the trends in the educational programs, and the programs that are being planned for the state.

Oklahoma has a specially funded Linear Programming Project under the direction of Charles O. Hopkins, and one of the many inputs into this project is the manpower information from OTIS. Upon termination of this project, the State Department of Vocational and Technical Education will have the ability to optimize program cost and program need in the process of selecting new training programs for the state.

Even though the OTIS project is actually based upon a yearly look at the manpower supply and demand situation, the material is used on a daily basis to make decisions on the long run as well as the short run. The OTIS information has controlling as well as evaluation information. OTIS information is used in the evaluation system so that we will eventually produce a product index for each of the vocational programs in Oklahoma. The supervisor and administration use the product index to decide whether or not the students are getting jobs after they have completed the training program. The OTIS information is easily adapted to long-range planning by considering the gross demand, the gross supply, the projected supply, and the projected demand to determine a projected figure for occupations. We should keep in mind that long-range projections can be very dangerous.

The State Department considers OTIS to be an excellent system, but at the same time we are not satisfied with it to the point that we are not searching for better ways to product OTIS and for better information to put into OTIS. We think, for example, that it is very important to have information from areas or regions smaller than the state. In the 90 training clusters shown in OTIS, we show a net demand for more training in '79. When we reported net demand for each of the state planning regions, there were only 24 clusters with net manpower demand in every region in the state. Consequently, we could not do adequate planning with only statewide information.

General Discussion and Critique of Occupational Training Information System

One question that is often asked is: How accurate is OTIS? This is a very difficult question to answer specifically, but research is constantly being done to try to check and improve OTIS data.

In 1970, a comparison was made of the number of unfilled job openings in the Oklahoma City SMSA as reported by the Oklahoma Employment Security Commission and the size of the net manpower requirements as projected by the 1970 OTIS report. There was a .89 correlation between the two reports.

When comparing student follow-up information and OTIS projections from each occupational area, a general idea is developed regarding the need for training. We used this general idea approach to decide on areas for further study. We feel that we continue to improve the information in OTIS by constantly developing better methodology in the preparation of OTIS.

This year we have completed statewide surveys in industrial arts and business and office education which were not funded by vocational education money, so that our supply information will be more accurate for these occupations.

Automobile mechanics, refrigeration mechanics, and welding are the occupations shown in OTIS which have the largest over-supply of trained personnel, but there are some indications from follow-up data in the student accounting system that this is not true. Consequently, we have finished a complete population survey of the industries that employ automobile mechanics, refrigeration mechanics, and welders in Tulsa County. With this demand information, the Oklahoma Employment Security Commission and the State Department of Vocational and Technical Education will check for possible errors in the supply or demand data.

We have had a number of people question us regarding the firm survey technique to gather demand information. We think that the Oklahoma Employment Security Commission Research Division personnel in Oklahoma are professionals in doing their job. We have the greatest confidence in them personally and in their work. We recognize that the firm survey technique is expensive. Also, we realize firms do not always do an adequate job of projecting their future occupational needs, particularly the smaller firms. The Oklahoma Employment Security Commission personnel, who are experts in the area, adjust the firm projections when they feel they are out of line. Consequently, we feel that many of the criticisms leveled at the firm survey technique projections do not hold true for Oklahoma. The OESC personnel have used the firm survey technique as long as any state and have, over the years, learned to modify it and have developed some expertise in its use. We do want to point out, however, that when a technique is developed that is better or will provide the same information at a lower cost, we will use it. We think, at this time, that we will be using both the Bureau of Labor Statistics Occupational Matrix and the firm survey technique to get the information that we need in the future. As more emphasis is placed on accountability by the legislators, school administrators, and the general public, all agencies and organizations that are involved in education are more and more concerned with student follow-up information. As better student follow-up information is developed, OTIS will consequently improve.

We feel that since 1968, we have made tremendous progress in our Management Information System in Oklahoma. The plans for the future include further development of our present system and development of other systems for management. The linear programming project is a good example. We feel that with the management inputs that we have in Oklahoma, the linear programming project should develop into an excellent management tool. Other systems in management that we might be able to add are being contemplated.

Since the current computerized OTIS system operating in Oklahoma has infinite capacity, the limitations lie in getting good input information. One input which could be added to OTIS has been discussed by the advisory committee. The committee has discussed the possibility of including on-the-job training. Information regarding on-the-job training from all of the various firms over Oklahoma is not available at the present time. We will probably complete a study on the on-the-job training supply and demand before we decide whether or not to use it as an annual supply input for OTIS.

APPENDICES

APPENDIX A

PROCEDURE FOR PROGRAM APPROVAL

Procedure for Program Approval

Program requests from schools should be approved on the following basis:

1. New occupational training program requests will be approved only in areas of manpower demand specified in the State Plan as indicated by OTIS or valid local surveys.

    a. The occupational training program need for the State Plan will be derived from OTIS and furnished by the Planning Unit in the Division of Research, Planning, and Evaluation.

    b. Local survey information will be validated by the Division of Research, Planning, and Evaluation if they accompany program requests from the local level.

Sequential Steps for Program Approval

Sequence	Steps
1.	The Coordinator of Planning will supply the Assistant State Director of the Educational Programs Division a priority listing of program demands in each occupational area.
2.	The Assistant State Director of the Educational Programs Division will supply the State Director with the program recommendations for his reaction.
3.	The State Director will review the recommended programs and give his reactions to the Assistant State Director of the Educational Programs Division.
4.	The Assistant State Director of the Educational Programs Division will supply the State Supervisors and the State Coordinator of Area Schools a list of the recommended programs for approval.
5.	The State Coordinator of Area Schools and State Supervisors will supply the Assistant State Director of the Educational Programs Division a list of programs in priority order for each school under supervision.
6.	The Assistant State Director of the Educational Programs Division will supply the Finance Director the priority listings to be budgeted until the funds allocated for each of the area schools and the divisions have been exhausted.
7.	The Director of Finance will submit the budgets to the Assistant State Director of the Educational Programs Division.

8. The Assistant State Director of the Educational Programs Division will supply the State Director the budgets for the area schools and the divisions for his review and recommendations.

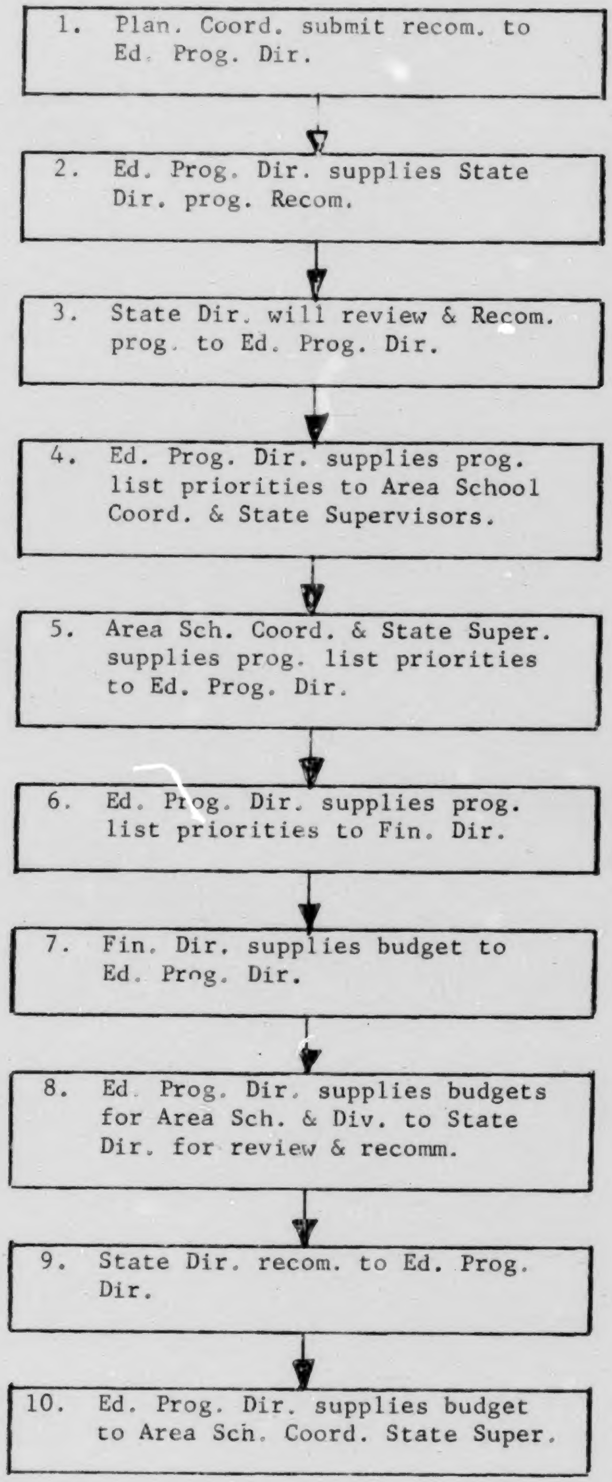
9. The State Director will give his recommendations to the Assistant State Director of the Education Programs Division.

10. The Assistant State Director of the Educational Programs Division will supply the State Coordinator of Area Schools and the State Supervisors the budgets and the approved programs to be relayed to the local institutions.

Note: Both the State Coordinator of Area Schools and the State Supervisors will supply the Assistant State Director of the Educational Programs Division a list of all program requests received.

Note: The State Coordinator of Area Schools and the State Supervisors should jointly establish the priority listing of programs for the Area Schools.

Note: The State Supervisors should supply the amount of dollars for equipment, materials, and personnel recommended for each program to be budgeted.

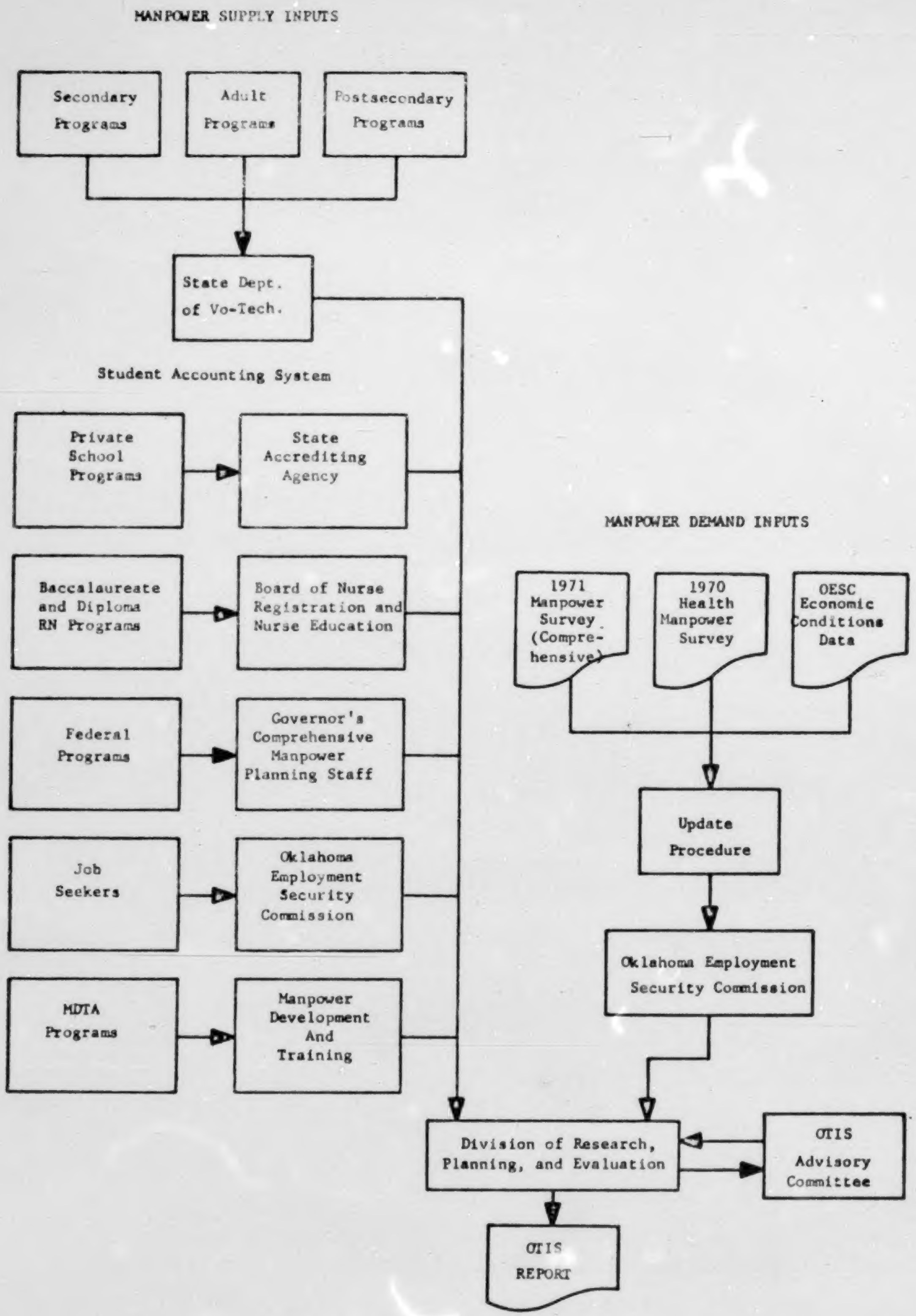


1. Plan. Coord. submit recom. to Ed. Prog. Dir.
2. Ed. Prog. Dir. supplies State Dir. prog. Recom.
3. State Dir. will review & Recom. prog. to Ed. Prog. Dir.
4. Ed. Prog. Dir. supplies prog. list priorities to Area School Coord. & State Supervisors.
5. Area Sch. Coord. & State Super. supplies prog. list priorities to Ed. Prog. Dir.
6. Ed. Prog. Dir. supplies prog. list priorities to Fin. Dir.
7. Fin. Dir. supplies budget to Ed. Prog. Dir.
8. Ed. Prog. Dir. supplies budgets for Area Sch. & Div. to State Dir. for review & recomm.
9. State Dir. recom. to Ed. Prog. Dir.
10. Ed. Prog. Dir. supplies budget to Area Sch. Coord. State Super.

SEQUENTIAL STEPS FOR PROGRAM APPROVAL

APPENDIX B

OTIS PROCEDURAL FLOW CHART


MANPOWER SUPPLY INPUTS
Secondary Programs
Adult Programs
Postsecondary Programs
State Dept. of Vo-Tech.
Student Accounting System
Private School Programs
State Accrediting Agency
Baccalaureate and Diploma RN Programs
Board of Nurse Registration and Nurse Education
Federal Programs
Governor's Comprehensive Manpower Planning Staff
Job Seekers
Oklahoma Employment Security Commission
MDTA Programs
Manpower Development And Training
MANPOWER DEMAND INPUTS
1971 Manpower Survey (Comprehensive)
1970 Health Manpower Survey
OESC Economic Conditions Data
Update Procedure
Oklahoma Employment Security Commission
Division of Research, Planning, and Evaluation
OTIS Advisory Committee
OTIS REPORT

OTIS PROCEDURAL FLOW CHART

APPENDIX C

NET ADDITIONAL MANPOWER REQUIREMENTS, 1973

NET ADDITIONAL MANPOWER REQUIREMENTS
1973

STATEWIDE TOTALS

CLUSTERS OF OCCUPATIONS	DEMAND	SUPPLY							DEMAND MINUS SUPPLY	CLUSTERS OF PROGRAMS
		OESC REGIS-TRANTS	SECONDARY	PUBLIC POST SECONDARY	PUBLIC ADULT	FEDERAL MDTA	FEDERAL OTHER FEDERAL	PRIV-ATE SCHOOLS		
Cluster No. 180										
078.281.0 Medical Technologist	94	8						42		
078.381.0 Medical Laboratory Assistant	68	12						7		
078.381.2 Medical Laboratory Technician	41									
				11				114		070203 Medical Laboratory Assisting
Total	203	20		11				163	9	
Cluster No. 190										
075.378.0 Registered Nurse Bacc, Dipl, Assoc	733	42					4			
				282						070301 Nursing (Associate Degree)
Total	733	42		282			4		405	
Cluster No. 200										
079.378.0 Licensed Practical Nurse (L.P.N.)	839	142					7	30		
			7	438						070302 Practical (Voc) Nursing
Total	839	142	7	438			7	30	216	

APPENDIX D

A DESCENDING ORDERING OF PROGRAM CLUSTERS RANKED BY STATEWIDE NET MANPOWER DEMAND

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A DESCENDING ORDERING OF PROGRAM CLUSTERS

RANKED BY STATEWIDE NET MANPOWER DEMAND

RANK	PROGRAM CLUSTERS	STATE-WIDE	N. E. #1	M. E. #2	S. E. #3	S. C. #4	E. C. #5	TULSA SMSA #6	N. C. #7	OKLA. CITY SMSA #8	S. W. C. #9	S. W. #10	N. W. #11
24	Cluster: 70 Occupations: 166.168.0 Special Agent 169.188.0 Underwriter 241.168.0 Claim Adjuster 250.258.0 Insurance Salesman Programs: 0041300 Insurance	229	3	6	1	11	6	48	10	122	16	6	1
25	Cluster: 120 Occupations: 252.358.0 Service Salesman Programs: 0040100 Advertising Serv 0040400 Finance & Credit 0041500 Personal Services 0041900 Transportation	217	18	23	7	18	6	58	23	60	2	1	3
26	Cluster: 200 Occupations: 079.378.0 Licensed Practical Nurse (L.P.N.) Programs: 0070302 Practical (Voc) Nursing	215	55	29	37	28	31	63	58	96	79	30	11

MANPOWER FORECASTING IN PENNSYLVANIA

JOHN SENIER
AND
STEPHEN J. FRANCHAK

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OVERVIEW OF THE TOTAL MANAGEMENT INFORMATION SYSTEM

Historical Development

The Pennsylvania State Board of Education and the State Advisory Council for Vocational Education in 1967 authorized a comprehensive study of vocational and technical education in the Commonwealth. This study completed in August 1969 produced significant results (Arnold, 1970).

One of the major outcomes from the 1969 study was the development of a systematic procedure for vocational education program planning (Figure 1). A primary input for this type of planning was defining manpoer supply/demand data. The identification of these data was based upon the development of a manpower supply/demand model which focused on the definition of industry characteristics and population characteristics over time (Figure 2). Subsequent efforts to refine this initial concept eventually led to the present supply/demand model which reflects additional information and data.

A recommendation set forth in the 1969 vocational education study suggested that the Research Coordinating Unit, Bureau of Vocational Education, and other involved bureaus of the Department of Public Instruction[1] set up ways and means to continue the collection and analysis of data and information on economic developments, manpower supply and demand projections, graduate follow-up information and other inputs required in the systems planning procedure (Arnold, 1970).

Guided by this recommendation, the Research Coordinating Unit, using the manpower methodology from the 1969 study, developed a publication on occupational supply/demand (McNamara and Franchak, 1970). This report updated the statewide supply/demand data found in the 1969 study and, in addition, developed statistics on the 12 major and three selected smaller labor market areas. Also, this report developed and refined the supply information system originally developed in the 1969 study. The supply information component was computerized to provide a more flexible data base for program planners. This supply system used as its unit of analysis the vocational education graduate. This publication was replicated in 1971 with the intent of continuing the manpower methodology and providing annual occupational supply/demand data for state and local program planners and decision makers (Franchak and Bruno, 1971).

Throughout, it was recognized that vocational educators are the prime users of occupational data and that more and better occupational data were needed. More recently, higher education planners have become cognizant of the need for manpower data as input for their program planning and decision-making. As a consequence, considerable effort has

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[1] The name has been changed to the Department of Education.

I Socio-Economic Planning

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State-Level Planning:

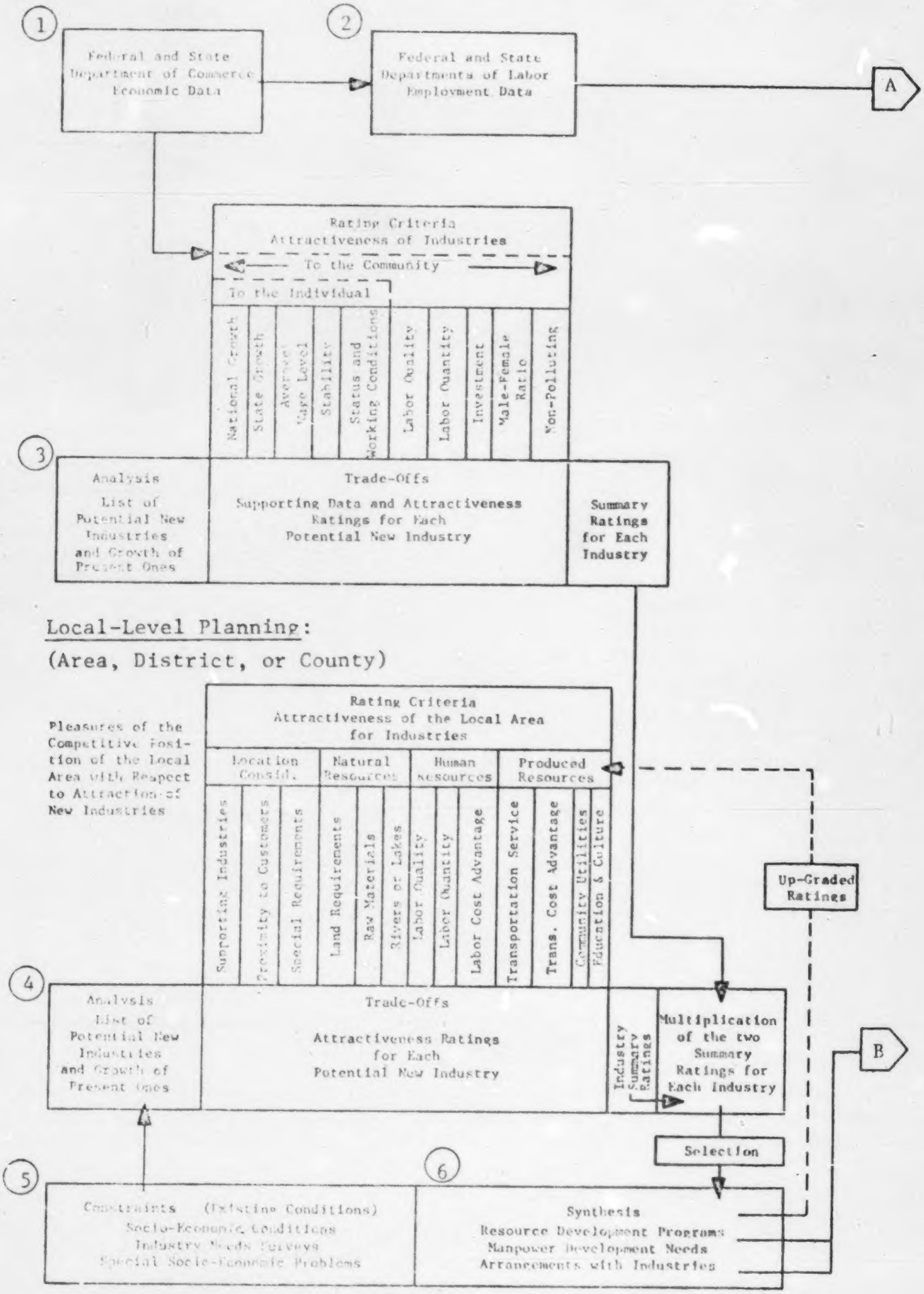
①
Federal and State Department of Commerce Economic Data
②
Federal and State Departments of Labor Employment Data
A
Rating Criteria
Attractiveness of Industries
To the Community
To the Individual
National Growth
State Growth
Average Wage Level
Stability
Status and Working Conditions
Labor Quality
Labor Quantity
Investment
Male-Female Ratio
Non-Polluting
③
Analysis
List of Potential New Industries and Growth of Present Ones
Trade-Offs
Supporting Data and Attractiveness Ratings for Each Potential New Industry
Summary Ratings for Each Industry
Local-Level Planning:
(Area, District, or County)
Measures of the Competitive Position of the Local Area with Respect to Attraction of New Industries
Rating Criteria
Attractiveness of the Local Area for Industries
Location Consid.
Natural Resources
Human Resources
Produced Resources
Supporting Industries
Proximity to Customers
Special Requirements
Land Requirements
Raw Materials
Rivers or Lakes
Labor Quality
Labor Quantity
Labor Cost Advantage
Transportation Service
Trans. Cost Advantage
Community Utilities
Education & Culture
Up-Graded Ratings
④
Analysis
List of Potential New Industries and Growth of Present Ones
Trade-Offs
Attractiveness Ratings for Each Potential New Industry
Industry Summary Ratings
Multiplication of the two Summary Ratings for Each Industry
B
Selection
⑤
Constraints (Existing Conditions)
Socio-Economic Conditions
Industry Needs Surveys
Special Socio-Economic Problems
⑥
Synthesis
Resource Development Programs
Manpower Development Needs
Arrangements with Industries

Figure 1. Statewide Vocational Education System Planning

II Voc-Ed Program* Planning

*(Program or Curriculum)

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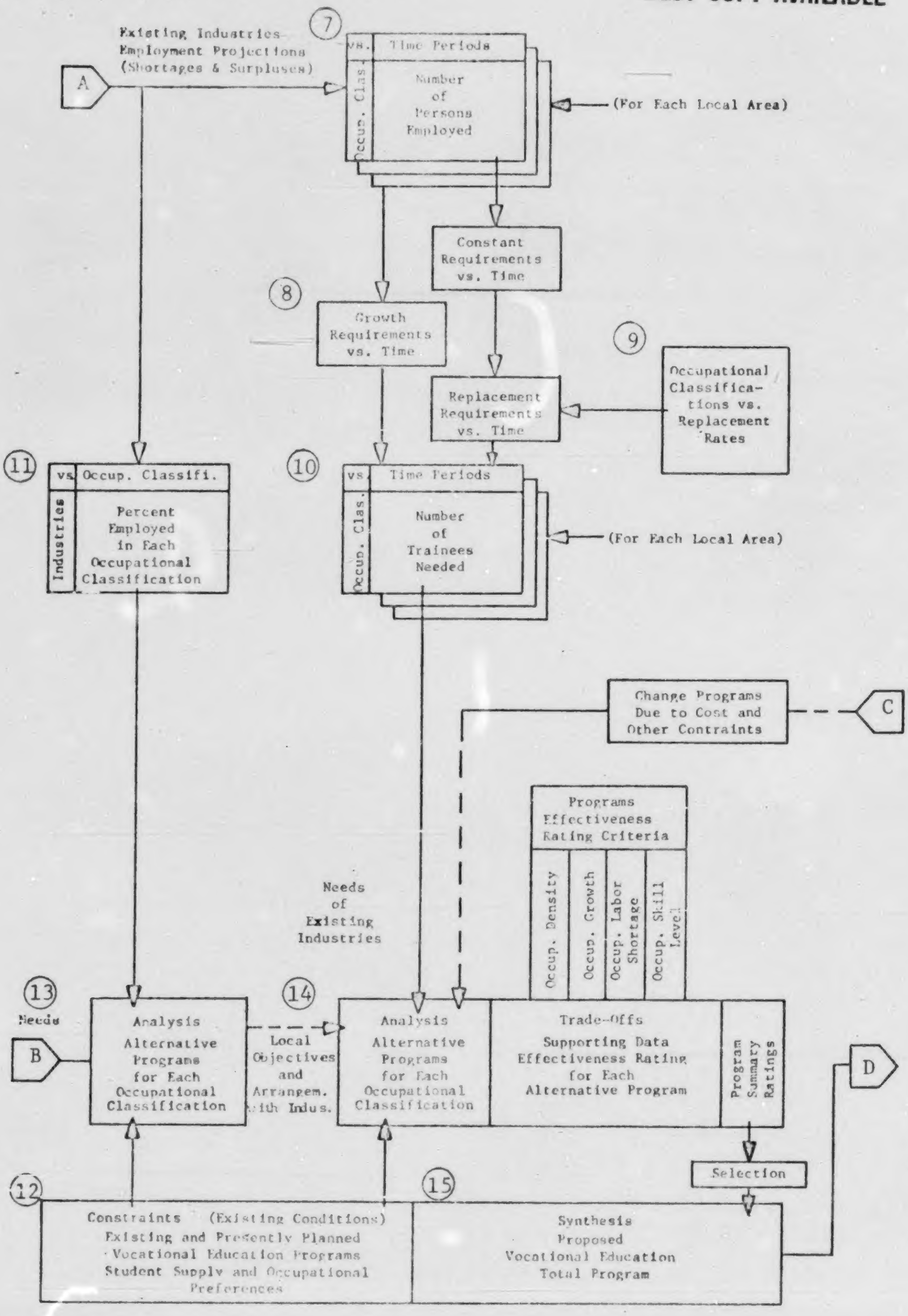

A
Existing Industries
Employment Projections
(Shortages & Surpluses)
7
vs.
Time Periods
Occup. Clas.
Number of Persons Employed
(For Each Local Area)
Constant Requirements vs. Time
8
Growth Requirements vs. Time
9
Replacement Requirements vs. Time
Occupational Classifications vs. Replacement Rates
11
vs.
Occup. Classifi.
Industries
Percent Employed in Each Occupational Classification
10
vs.
Time Periods
Occup. Clas.
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(For Each Local Area)
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Figure 1 (continued)

III Voc-Ed Resources Planning

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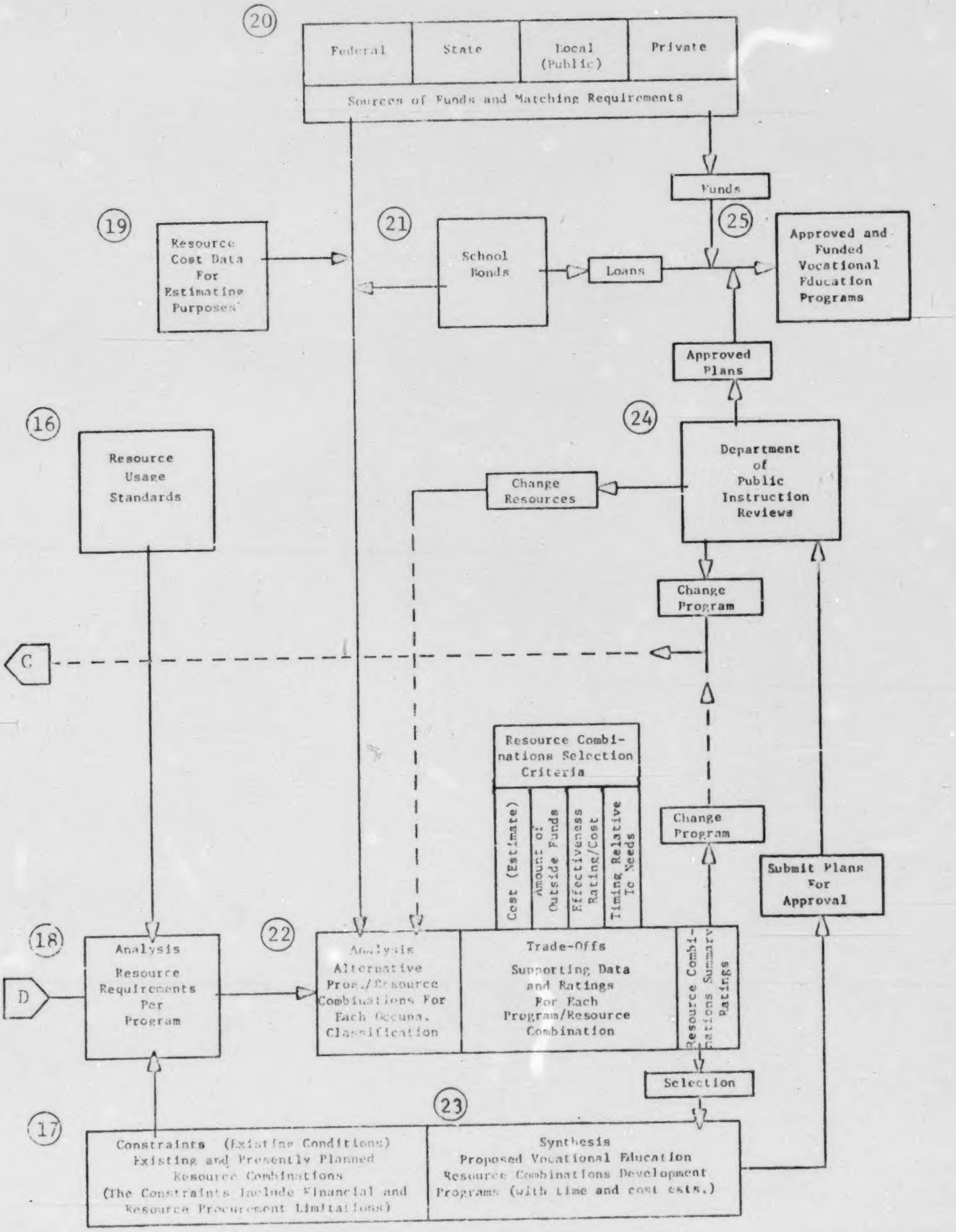
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Effectiveness Rating/Cost
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Analysis Alternative Prog./Resource Combinations For Each Occupa. Classification
Trade-Offs Supporting Data and Ratings For Each Program/Resource Combination
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Selection
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Constraints (Existing Conditions) Existing and Presently Planned Resource Combinations (The Constraints Include Financial and Resource Procurement Limitations)
Synthesis Proposed Vocational Education Resource Combinations Development Programs (with time and cost ests.)

Figure 1 (continued)

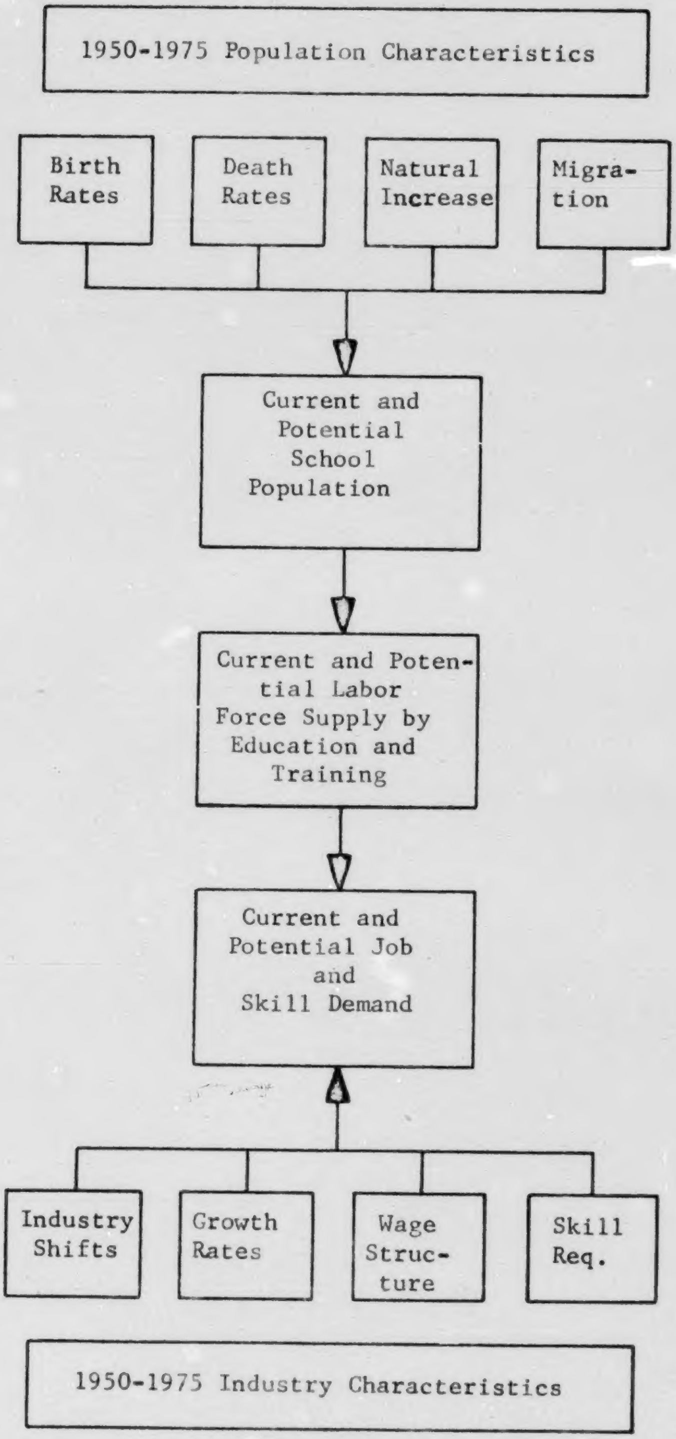
1950-1975 Population Characteristics
Birth Rates
Death Rates
Natural Increase
Migration
Current and Potential School Population
Current and Potential Labor Force Supply by Education and Training
Current and Potential Job and Skill Demand
Industry Shifts
Growth Rates
Wage Structure
Skill Req.
1950-1975 Industry Characteristics

Figure 2. Initial Conceptual Framework for the Development of the Manpower Supply/Demand Model

been expended by the higher education research staff of the Bureau of Information Systems in developing projections and models of manpower demand and supply for professions requiring baccalaureate and higher degrees. Thus, in May 1973, the Pennsylvania Department of Education, Bureau of Information Systems, attempted to unify the efforts of the department by establishing a working level designed to develop a centralized system for the generation of manpower research and information.

The individuals responsible for this operation are guided by the manpower research and information needs of user groups at the educational management, planning and operational levels of the Department of Education and associated agencies. As a result, existing and proposed data bases and manpower forecasting models are being developed and used in a coordinated system.

Overview of the Manpower Supply/Demand Model

Objectives

The basic goals were to establish a centralized system for providing and generating manpower information and research and to disseminate that information to persons at all levels responsible for occupational education planning and decision-making. To accomplish these goals, certain basic objectives were established. Specifically, it was necessary to define within the parameters of the educational system:

1. what manpower information was necessary or would be useful in the planning and programming process;
2. which forecasting model(s) would be most reliable and valid for generating occupational data and information;
3. what data elements were necessary as input to such a forecasting model(s);
4. what method(s) would best permit the interface of occupational demand with the occupational supply (graduates from educational training institutions); and
5. what strategies and procedures would be most successful for the delivery of manpower data and information to designated user groups.

Having identified these objectives, the basic direction for manpower research was established.

In an effort also to coordinate education's research activities with other educational agencies and governmental departments in Pennsylvania, strategies were developed for producing a common data base for the relevant manpower research and information. The rationale for this coordination was the avoidance of duplication of effort and a recognition of the fact that a comprehensive occupational supply/demand model was beyond the capabilities of any one agency or department.

Subsequent to the development of the basic supply/demand model as published in the 1969 Pennsylvania vocational education study, strategies and procedures were also developed for fusing the manpower information and research efforts with the planning base of educational planners and decision-makers. To this end, a mechanism was developed for filtering certain data elements from the data bases to give the user a level of detail applicable to his needs. The first effort was developed as a part of the publication: Planning Vocational Education Programs in Pennsylvania: Guidelines for the Use of Labor Market Information (McNamara and Franchak, 1970). This resulted in a computerized supply information component which used as its unit of analysis the individual vocational education graduate. For each graduate, selected information was obtained, including:

- county in which he received his occupational training;
- type of school he attended;
- occupation for which he was prepared; and
- the year in which training was completed.

Organization

The Bureau of Information Systems has the primary responsibility for manpower research and information for the Pennsylvania Department of Education. The director of the bureau, Seon H. Cho, has established a task force within the Division of Research to be responsible for this subsystem operation.

Relationship of the Model to Decision-Makers

The primary users of this system have been the State Department of Education personnel and local educational agencies responsible for vocational education planning and decision-making. Specifically, the Division of Administrative and Planning Services, Bureau of Vocational Education, in preparing the annual vocational education State Plan and for providing support at the local level for program planning, have been the primary users. More recently, other agencies within the Department of Education have identified a need for occupational supply/demand data. These include the Office of Higher Education, Bureau of Higher Education Planning, and the Division of Pupil Personnel Services.

Agencies outside the Department of Education who have not only contributed input data to assist in developing the system but have also used certain outputs for their specific functions have included the

Governor's Office of the Budget (Division of Planning and Programs), the Governor's Office of State Planning and Development, and the Pennsylvania Department of Labor and Industry.

Operational Description of the Model

The operation is financially supported as a function within the Division of Research, Bureau of Information Systems, Pennsylvania Department of Education. Funds are appropriated from the Bureau of Vocational Education to support this effort.

The Bureau of Information Systems has committed personnel for research, development and operation of this manpower research and information system. The personnel include a coordinator, three research associates, systems analyst, programmer-analyst, and a clerk-typist.

The annual operating cost for this system, which includes the research and development, operational and maintenance functions, has not been finalized at this time. Also, it should be noted that at the present time the assigned personnel have other responsibilities within the Division of Research. However, an estimated $17,000 of personnel salaries is involved in the maintenance of the existing operating components of the supply/demand model for the projected fiscal year 1973-1974. This includes only those individuals who will have the responsibilities for the generation of manpower supply/demand data dealing with occupations requiring less than baccalaureate-degree education and training. The following personnel (titles) and their estimated percentage of working time devoted to this function include: a coordinator of manpower research (50%), research associate (20%), systems analyst (5%), and clerk-typist (33%).

Input and Output[2]

In developing the initial supply/demand model (Figure 3), it was evident that many data elements contained limitations which restricted the output for meeting local planning needs. For example, occupational employment and demand data were only available for selected areas (major SMSAs) and were based on 1960 census data. Thus, it was decided that when the supply/demand model was updated using 1970 census data (the primary data base for projecting occupational employment), improvements would be incorporated which would eliminate some of the major limitations and reinforce certain assumptions which would provide for a higher degree of validity in the manpower data.

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[2] See Tables 1 and 2.

Table 1. Input Data for Initial Supply/Demand Model

Input	Source of Data	Method of Collection	Method of Entry	Frequency of Collection	Output Report Number and Destination
Occupational Employment	Pennsylvania Department of Labor and Industry	Base data collected from existing files. Projections calculated using BLS' "Tomorrow's Manpower Needs" methodology.	Punch Card	one-time	"1960 Census and 1970, 1975 Projected Total Employment" "Planning Vocational Education Programs in Pennsylvania"
Occupational Withdrawal Rates	Pennsylvania Department of Education	Calculated on the basis of the male-female distribution in occupations. (1960 census)	Punch Card	one-time	"Planning Vocational Education Programs in Pennsylvania"
Supply					
1. Public Secondary Vocational/Technical Graduates	Vocational Education Management Information System (VEMIS)	Base data is collected by VEMIS using machine scannable forms. Each student fills out a form.	Optical Reader	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
Community College Graduates	VEMIS	Base data is collected by VEMIS using machine scannable forms. Each student fills out a form.	Optical Reader	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
3. Private Trade and Technical School Graduates	DEBE-375B Survey Form	Submitted by schools to Department of Education, Division of Private Schools	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out

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Table 1 (continued)

	Input	Source of Data	Method of Collection	Method of Entry	Frequency of Collection	Output Report Number and Destination
4.	Private Business School Graduates	DEBE-375B Survey Form	Submitted by schools to Department of Education, Division of Private Schools	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
5.	State Trade and Technical School Graduates	Individual Institutions	RCU requests data from individual institutions	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
6.	MDTA Graduates	Pennsylvania Department of Labor and Industry	Tabulated from Labor and Industry files	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
7.	State Retraining Act Graduates	Pennsylvania Bureau of Vocational Education, Retraining Division	Tabulated from files	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
8.	Private Jr. College Graduates	Pennsylvania Department of Education, Division of Statistics	Tabulated from work sheets	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
9.	Two-Year Programs in Four-Year Colleges Graduates	Pennsylvania Bureau of Vocational Education, Retraining Division	Tabulated from work sheets	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out

Table 1 (continued)

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Input	Source of Data	Method of Collection	Method of Entry	Frequency of Collection	Output Report Number and Destination
10. Other Graduates	Bureau of Vocational Rehabilitation, Pennsylvania Apprentice and Training Council, Educational and Training Division of the Bureau of Corrections, Correspondence Schools, Job Training Programs in Industry	Tabulated from existing files	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out

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Table 2. Input Data for Present Supply/Demand Model

Input	Source of Data	Method of Collection	Method of Entry	Frequency of Collection	Output Report Number and Destination
Occupational Employment	National Planning Association	Data base collected from existing Labor and Industry files and 1970 census. Calculations - NPA methodology.	Punch Card	one-time (updated yearly)	Computer print-outs and selected reports
Occupational Withdrawal Rates	Pennsylvania Department of Education, Division of Research	Calculated on the basis of the male-female distribution in occupations. (1950, 60, 70 census)	Punch Card	one-time	Computer print-outs and selected reports
Public Secondary Instructional Program/Occupation Matrix	VEMIS	Survey of graduates from public secondary vocational-technical programs	Magnetic Tape	yearly	"Supply/Demand Model for Vocational Education Planners: Phase 1"
Postsecondary I/O Matrix	VEMIS	Survey of graduates from postsecondary programs	Magnetic Tape	yearly	"Supply/Demand Model for Vocational Education Planners: Phase 2"
High School Dropout I/O Matrix	VEMIS	Survey of dropouts from secondary programs	Magnetic Tape	yearly	Computer print-outs and selected reports
Baccalaureate Degree I/O Matrix	Pennsylvania Department of Education, Division of Statistics	Survey of baccalaureate degree graduates	Magnetic Tape	yearly	Computer print-outs and selected reports

Table 2 (continued)

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Input	Source of Data	Method of Collection	Method of Entry	Frequency of Collection	Output Report Number and Destination
Supply					
1. Public Secondary Vocational-Technical Graduates	Vocational Education Management Information System (VEMIS)	Base data is collected by VEMIS using machine scannable forms. Each student fills out a form.	Optical Reader	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
2. Community College Graduates	VEMIS	Base data is collected by VEMIS using machine scannable forms. Each student fills out a form.	Optical Reader	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
3. Private Trade and Technical School Graduates	DEBE-375B Survey Form	Submitted by schools to Department of Education, Division of Private Schools	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
4. Private Business School Graduates	DEBE-375B Survey Form	Submitted by schools to Department of Education, Division of Private Schools	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
5. State Trade and Technical School Graduates	Individual Institutions	RCU requests data from individual institutions	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
6. MDTA Graduates	Pennsylvania Department of Labor and Industry	Tabulated from Labor and Industry files	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out

Table 2 (continued)

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Input	Source of Data	Method of Collection	Method of Entry	Frequency of Collection	Output Report Number and Destination
7. State Retraining Act Graduates	Pennsylvania Bureau of Vocational Education, Retraining Division	Tabulated from files	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
8. Private Jr. College Graduates	Pennsylvania Department of Education, Division of Statistics	Tabulated from work sheets	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
9. Two-Year Programs in Four-Year Colleges Graduates	Pennsylvania Department of Education, Division of Statistics	Tabulated from work sheets	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
10. High School Dropouts	VEMIS	Master files on High School enrollments	Magnetic Tape	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
11. Military Returnees	Selective Service	Tabulated from files	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
12. Baccalaureate Degree Graduates	Pennsylvania Department of Education, Division of Statistics	Tabulated from published report	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out

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Table 2 (continued)

Input	Source of Data	Method of Collection	Method of Entry	Frequency of Collection	Output Report Number and Destination
13. Other Graduates	Bureau of Vocational Rehabilitation, Pennsylvania Apprentice and Training Council, Education and Training Division of the Bureau of Corrections, Correspondence Schools, Job Training Programs in Industry	Tabulated from existing files	Punch Card	yearly	"Planning Vocational Education Programs in Pennsylvania" and computer print-out
Trade-Offs					
1. Special Needs	1970 Census		Punch Card	one-time	
2. Occupational Growth	Rating is calculated as part of total computer output				
3. Occupational Density	Rating is calculated as part of total computer output				
4. Occupational Shortage/Surplus	Rating is calculated as part of total computer output				
5. Occupational Skill Rating	"Dictionary of Occupational Titles"	Tabulated	Punch Card	one-time	

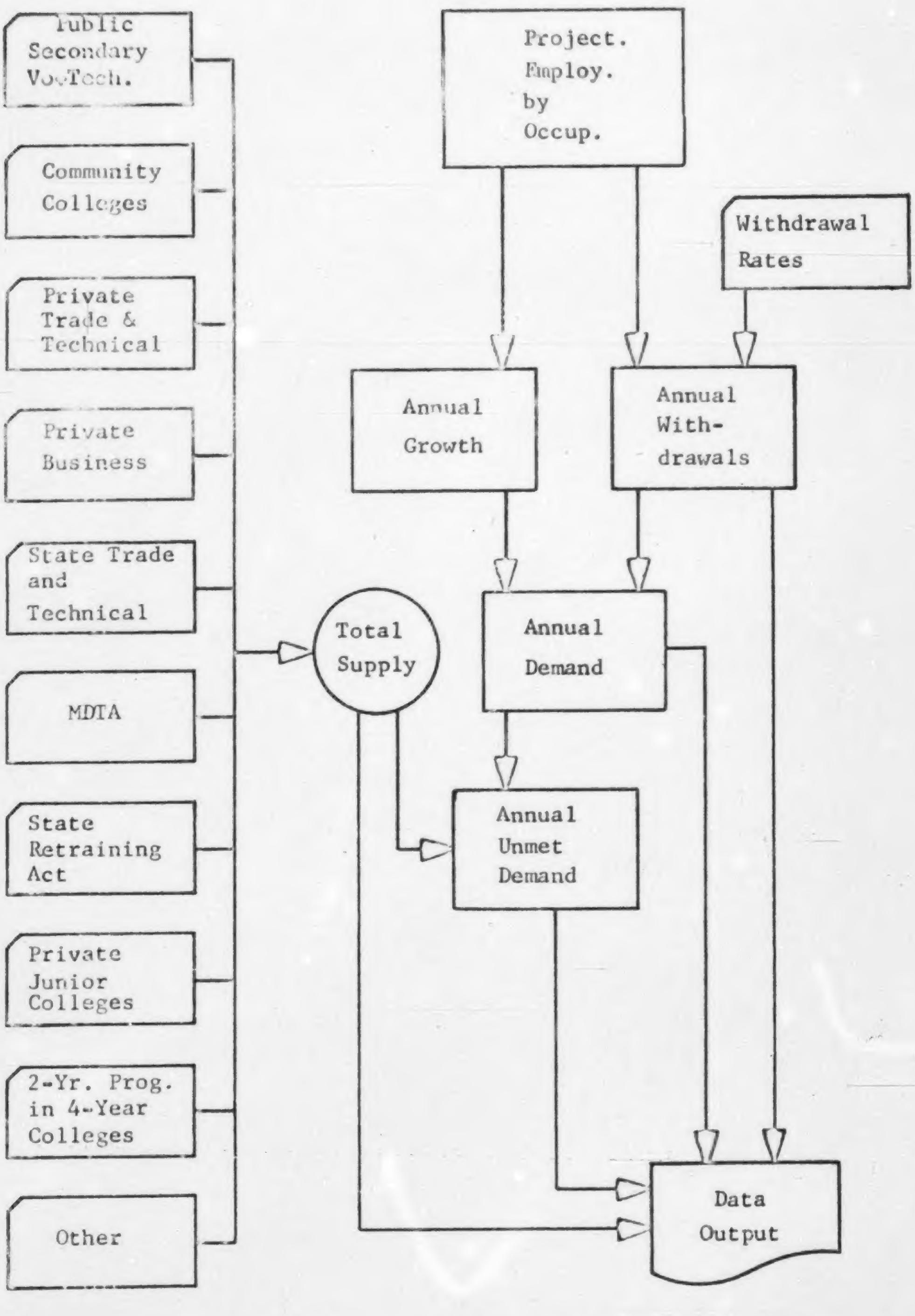

Figure 3. Flow Chart: Initial Supply/Demand Model

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Initially, it was assumed that a graduate from a particular program would enter the occupation for which trained. Thus, for example, it was assumed that a graduate from an auto mechanics program would enter the occupation motor vehicle mechanics. This assumption was made because no information was available on the percentage of the graduates by program and institution who enter the labor force and what percentage actually find employment directly related to their program study. In an effort to overcome this limitation, the Pennsylvania Department of Education, with the assistance of the Pennsylvania State University, Department of Vocational Education, developed a number of instructional program/occupation matrices by institution type based on follow-up surveys of graduates (Senier, et al., 1972; Senier and Enderlein, 1973). These matrices will permit an initial adjustment of the potential supply in terms of the labor force participation rate by program and institution and further permit a determination of the number of graduates by program and institution entering a particular occupation. At present, instructional program/occupation matrices have been developed for secondary vocational-technical program graduates and for postsecondary vocational program graduates (community colleges, two-year programs in four-year institutions, and private business colleges).

Recognizing that between one-fourth and two-thirds of the total demand for skilled manpower (depending on the occupation) is attributable to occupational withdrawal for reasons such as death, retirement, or in the case of women, leaving the labor force due to marriage and/or the birth of a child, a major effort was made to develop more accurate withdrawal rates for individual occupations. The methodology used in developing these rates is similar to that outlined in Tomorrow's Manpower Needs, Volume I (U.S.D.L., 1969). Trend line analysis was used to estimate withdrawal rates over time for selected occupations. These rates were developed for the years 1950, 1960, and 1970 (Senier, 1973, unpublished).

In order to develop projected employment information to 1980, 1985, and 1990, the RCU entered into a cooperative project with the Governor's Office of State Planning and Development under contract with the National Planning Association. The expected outcome is the development of projected employment and annual average growth data by occupation, by industry for Pennsylvania and its 48 labor market areas. This project will update the occupational employment projections developed in the 1969 vocational education study (Arnold, 1970).

In developing the initial supply/demand model, it was recognized that the ten sources of supply were by no means exhaustive. The basic limitation was a lack of information on other sources. In an effort to overcome this limitation, exhaustive research was conducted. In addition, the cooperation of other Commonwealth government personnel was solicited. As a result, information is now available on the supply to the labor force resulting from military returnees and dropouts from high school. Also, as a result of efforts by Dr. Toombs of the Pennsylvania State University, the Bureau of Higher Education Planning and the Division of Research, yearly follow-up surveys of baccalaureate-degree graduates in Pennsylvania are being planned, thus making available information on a major source of trained manpower for those occupations requiring a baccalaureate degree.

In order to aid local educational planners in their systematic analysis of the occupational information supplied by the revised supply/demand model, an evaluation of the output in the form of "trade-offs" has also been incorporated. This was done so that a comparative analysis of the occupational information would facilitate the establishment of priorities for the local program planner. The basic idea was developed as a part of the systems approach to vocational education program planning (Arnold, 1970).

Recognizing that any one system cannot satisfy all user requirements, research time is allocated to develop specialized information on a user demand basis. During the last two years, research reports on the following subjects have been prepared primarily for individuals interested in occupations requiring a baccalaureate or professional degree:

- Physician Demand and Supply
- Dentist Demand and Supply
- Demand and Supply of Allied Health Personnel
- Higher Education Faculty Demand and Supply
- Population Projections by Age, Sex, and Area
- Net Migration by Age, Sex, and Area

Resource Requirements

Collection of all the supply data from the sources previously described takes approximately two man-months. After the data is reformatted into a compatible form using a computer program which requires about 65K, a magnetic tape file is created on which the supply information is catalogued by area, institution type, and program. The initial data files are also accessed for the development of additional instructional program/occupation matrices. The computer programs (one for each type of matrix) that accomplish this require 170K.

All data are stored on magnetic tape in the library of the Pennsylvania Department of Education Computer Center. The data are updated with new information on a yearly basis, but old tapes are not altered, and new tapes are created at the collection phase. This is done so that historic data can be accessed at any time to provide background data to educational planners and to establish a sound data base for subsequent research for improving the supply/demand model.

General Discussion and Critique of the Model

It is anticipated that the present supply/demand model (Figure 4), as described above, will be fully operational by the end of this year.

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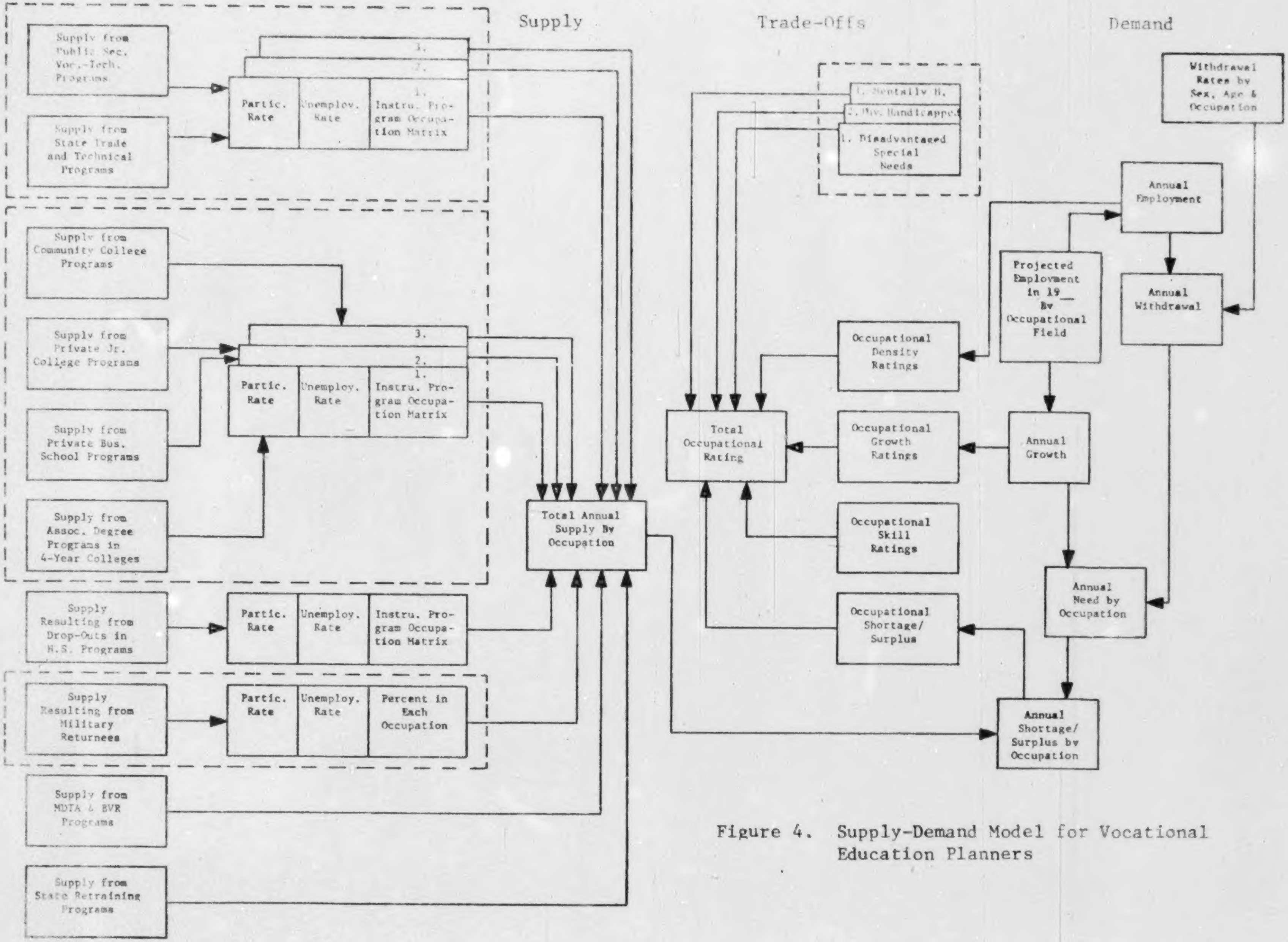
Supply
Trade-Offs
Demand
Supply from Public Sec. Voc.-Tech. Programs
Supply from State Trade and Technical Programs
Supply from Community College Programs
Supply from Private Jr. College Programs
Supply from Private Bus. School Programs
Supply from Assoc. Degree Programs in 4-Year Colleges
Supply Resulting from Drop-Outs in H.S. Programs
Supply Resulting from Military Returnees
Supply from MDTA & BVR Programs
Supply from State Retraining Programs
Partic. Rate
Unemploy. Rate
1. Instru. Program Occupation Matrix
2.
3.
Percent in Each Occupation
Total Annual Supply By Occupation
1. Mentally H.
2. Phy. Handicapped
1. Disadvantaged Special Needs
Total Occupational Rating
Occupational Density Ratings
Occupational Growth Ratings
Occupational Skill Ratings
Occupational Shortage/ Surplus
Withdrawal Rates by Sex, Age & Occupation
Annual Employment
Annual Withdrawal
Projected Employment in 19__ By Occupational Field
Annual Growth
Annual Need by Occupation
Annual Shortage/ Surplus by Occupation

Figure 4. Supply-Demand Model for Vocational Education Planners

Although many improvements have been incorporated within the model, basic limitations still exist, and many variables such as occupational mobility and labor force commutation are still being investigated concerning their appropriateness for being included within the model. For this reason, the Pennsylvania Department of Education, Bureau of Information Systems, is exploring the possibility of further uniting its cooperative research efforts with the Department of Labor and Industry, Department of Commerce, Department of Health and especially with the Governor's Office of State Planning and Development in view of their efforts to develop a comprehensive economic and demographic data system for the Commonwealth. At present, a combined research effort between that office and the Division of Research is being conducted to determine the effect of commuting on the labor force for the counties within the state.

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FINANCIAL ACCOUNTING
AND
RESOURCE ALLOCATION

RESOURCE ALLOCATION SUBSYSTEMS IN THE NEW JERSEY STATE EDUCATION AGENCY

EDMOND H. WEISS

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OVERVIEW OF THE TOTAL MANAGEMENT INFORMATION SYSTEM[1]

Historical Development

The current calendar year has been one of uncertainty in the New Jersey Department of Education. It lost its Commissioner in spring, 1973, and will probably not replace the Acting Commissioner until early in 1974. In the summer of 1973, the director of the Office of Management Information left the office. While there has been much activity in the Department, and an untiring attention to the needs of the State, there has been little apparent progress in the area of Management Information Systems. The image of the SEA's system presented here is based on observations made in fall, 1972. In some respects, progress has been made; in others the Department is farther away from its goals today than it was a year ago.

There is no doubt that the development of a genuine MIS will be among the major concerns of New Jersey's next Commissioner of Education.

Organization and Design

There are two main centers of management information processing in the New Jersey Department of Education. The Division of Administration and Finance operates a large statistical operation, handling data about finance, staff, students, curriculum, facilities and even some community characteristics; the finance operation is largely manual and produces very few analyses or reports at present. In addition, the Branch of Statistics in the Office of Management Information (OMI) engages in a continually expanding program of centralized data management, including some forms control and inter-division coordination. The data-processing branch of the OMI services the statistical branch as well as most other persons in the Department requiring programming services. Note that the latter operation is known officially as the Department's Management Information System, even though it is clearly one of two (or more) information systems.

Finally, many offices and bureaus in the Department are developing data bases and processing capabilities on their own. Systems are under development in the Division of Field Services and Division of Vocational Education. The Department has refrained in recent months from overselling the notion of a fully integrated MIS, a notion which slowed early progress in MIS development. (See Figure 1.)

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[1] The two resource allocation subsystems described in this paper were developed by Government Studies and Systems, Inc., Philadelphia, Pa.

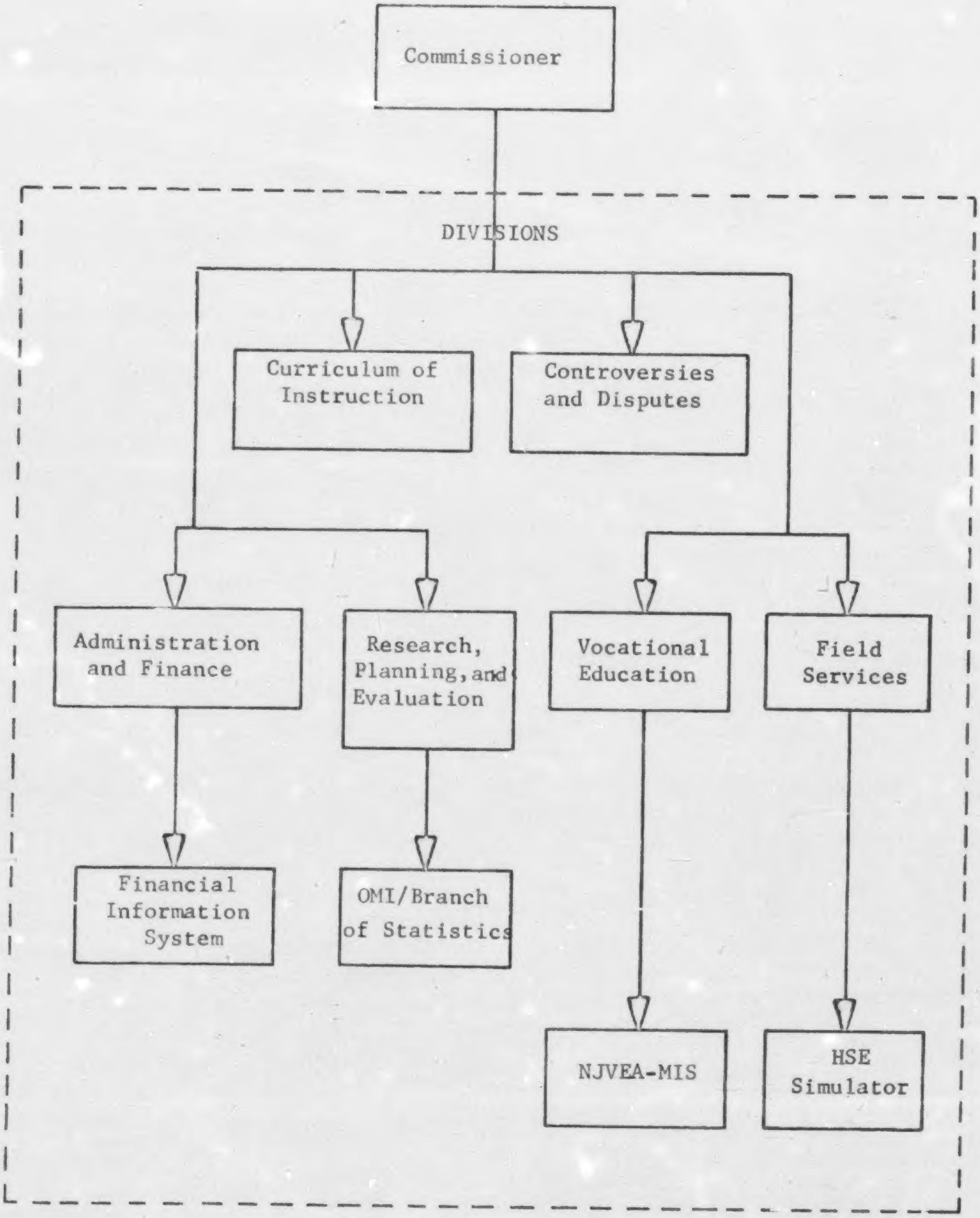
Commissioner
DIVISIONS
Curriculum of Instruction
Controversies and Disputes
Administration and Finance
Research, Planning, and Evaluation
Vocational Education
Field Services
Financial Information System
OMI/Branch of Statistics
NJVEA-MIS
HSE Simulator

Figure 1. MIS in the Structure of the New Jersey SEA

Current Capabilities and Future Plans

In short, New Jersey's MIS activities are, as in other SEAs, fragmented. However in MJDE there are two main fragments who cooperate with each other but maintain separate functional identities. Both systems have their own development plans.

The Division of Administration and Finance currently performs most of its data reduction and processing manually, but it uses its own small NCR computer to perform certain accounting calculations. It plans to upgrade its system so that statistical summaries and publications can be generated directly from a computer.

The OMI Branch of Statistics is in transition. At present it contracts keypunching services (its forms are largely pre-coded) and uses its limited staff for extensive edition. One person estimated that 60 percent of the returned forms have errors or anomalies in them. In fall, 1972, OMI created data bases using National CSS time-sharing services and utilized the RAMIS[2] data management system for file maintenance, updating, and reporting. Eventually, they hope to use RAMIS on a more locally accessible computer.

The OMI system plans to expand its files, consolidate more of the state's data-gathering into a single set of instruments, and generally secure enough staff to perform the increasingly heavy burden of operation. One rarely hears overzealous talk about complete centralization or fully integrated systems. The OMI people have practical, limited objectives and appear to be moving toward them despite recent setbacks.

Overview of the Resource Allocation Subsystems

This presentation is concerned primarily with two small components of the New Jersey SEA's MIS--the resource allocation subsystems used in the State's grants management of its Vocational Education Act monies and the subsystem used to determine allocations to high school equivalency projects. The former subsystem is located in the Vocational Education Division, the latter in the Bureau of Adult Education, Division of Field Services.

Resource allocation is an application quite different from other MIS uses. Typically it is a once-a-year proposition with one set of problems. It is in contrast to more typical management functions with their daily, weekly, or monthly transition schedules. Properly speaking an agency may develop resource allocation models and software without regard to its hardware constraints, because this once-a-year application need not be performed by the same people or same equipment. In the applications described below the data which figure in the resource allocation process are part of the routine information of the agency, but, in general, they need not be.

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[2] RAMIS = Rapid Access Managment Information System, a proprietary data management system developed by MATHEMATICA, Inc.

There are many different approaches to resource allocation. The approach most frequently observed in SEAs might be called the "disjointed-political-clairvoyant-detective" method. It is "disjointed" because individual project allocation decisions are made without reference to comprehensive considerations. It is "political" because who-knows-whom is a principal determinant of funding and speed of response. It is "clairvoyant" because the decision-makers somehow manage to constrain the future without doing any calculations and "detective" because one practically needs a subpoena to find out the data which influenced the decision.

At the opposite extreme is mathematical programming, in which all the candidate applications are considered simultaneously, and all the decision criteria are fully expressed in mathematical terms so that a computer can make all the allocation decisions. No agency of government has ever used this approach--despite frequent claims to that effect.

Between the two extremes are various gaming/simulation approaches, wherein decision-makers can consider groups of applications, "experiment" with policies to see which ones are intuitively satisfactory, use a system to produce a general plan, and then make some disjointed and political adjustments.[3]

In the subsystems which follow, the decision goals are somewhat different. The purpose of the vocational education model is to decide which project applications to fund or not fund, according to mathematical policy criteria. In the second, the purpose is to decide how the money should be distributed among all HSE candidates as a function of policy-relevant characteristics of the candidates.

Vocational Education Resource Allocation Subsystem

The system used by the Division of Vocational Education to process applications is part of a two-layered planning system. The major component is at the LEA-level; it is a system for matching programs to manpower demand and social demand. The output of the local planning

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[3] For a further discussion see Edmond H. Weiss, "Grants Management: A Systems Approach," Socio-Economic Planning Sciences, Vol. 7, pp. 457-70 (October, 1973).

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activities--a set of requests to fund specific courses--is the input to the state system (SVEA-MIS).

SVEA-MIS has several applications, described in Figure 2. The data base of past projects and current applications can be variously manipulated to produce an enormous range of alternative sorts and "breaks" using the Rapid Access Management Information System (RAMIS)--a system which allows non-programmers to formulate report generation statements with little training.

The unit record is a course, and a program is a set of courses associated with a given occupational area. The main variables used to sort and compare expenditures are county, LEA type (community college, area vocational school, school district, etc.), community type (urban/rural), program, and purpose. The alternative purposes for which applicants may seek funds are shown in Figure 3; note that they are illogical but correspond to the components of the funding legislation.

The resource allocation component of this system uses these data, and some others, to determine which course applications, in each purpose category, will be approved. The total allocation for each purpose category is a given constraint in the allocation process.

High School Equivalency Allocation Subsystem

The State of New Jersey supports about 175 projects throughout the State intended to help persons pass the General Education Development (GED) test and receive an equivalency diploma. Because the success of the program is measured almost entirely in terms of numbers of successful test-passers, it was thought originally that a linear programming model, which maximized number of successful test-passers within political constraints, would be feasible.

Any attempt to enhance the "productivity" of the program, however, would have taken money away from the poor, inner-city communities with the poorest performance. As a result, an approach less inimical to the districts with "greatest need" was developed.

The HSE program manager decided that all applicants, except in extreme circumstances, would be funded. Before requesting an application, however, he gathered a preliminary estimate of the number of student-hours in the program and the total dollars requested. Using a simulator, he determined the amount of state funds each applicant should "ask for" in the detailed application.

The approach was to assign a "base cost/hour" to be adjusted as a function of the applicant's characteristics. A brief profile was created for each applicant, describing all the relevant characteristics. In this way, the manager experimented with several policies until he found one which reflected his priorities and did not exceed the State's budget. Nine alternative sets of policies were tried in a three-week period before the "best" plan was developed.

- Descriptions of past year funding, according to various policy-relevant sorts.
- Individual "snapshots" of past projects.
- Entry, storage, and maintenance of all current application data.
- Ranking and allocation calculations, based on an allocation algorithm.
- Printing of award notification forms.

Figure 2. Capabilities of SVEA-MIS

PURPOSE	CODE
Disadvantaged	DIS
Handicapped	HAN
Postsecondary	PS
Adult	A
Secondary	S
Exemplary (Part D)	D
Research (Part C)	C
Consumer and Home-making (Part F)	F
Cooperative (Part G)	G
Work Study (Part H)	H

Figure 3. Purposes

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Operational Description of the Subsystems

Vocational Education Resource Allocation Subsystem

The allocation process begins with the collection of application data. (Note that the applicants have been aided by a system-generated report on their past year's awards.) The data from the applications are entered into the main application file. The process is described in Figure 4.

Reports are generated to the program administrators, on an LEA-by-LEA basis to facilitate editing and "negotiation" on line-item requests.

The adjusted application data are entered, and special "parametric" distribution reports are generated. These reports show the distribution of certain key characteristics of the applicant LEA's such as local tax rates, incidence of "drop out" in the school, and state aid. The purpose of these distribution reports is to divide all applicants into categories to which a weight of 1-10 may be assigned. The full range of parametric categories and the Version 1 weights are shown in Figure 5. Because all the weights are straightforward and "objective," the computer calculates the score for each course and ranks them under each purpose category.

The principal output of the allocation model is a report showing the projects under each purpose, in rank-order, with "NOT" appearing in the approval column for all those course applications which go beyond the total budget for that purpose.

This basic approval data may then be re-sorted by program, by county, by LEA type, by continuing-vs-new, or by a variety of other dimensions to inspect the full range of consequences of the policy weights.

Figure 6 shows a segment of the analysis of approvals for the "Office Occupations" program.

Adjustments are made in the first set of approvals to reflect technical errors, revised policies, or even political negotiations. Even after applicants are officially notified, there is still the possibility for "override" of the original allocation.

High School Equivalency Allocation Subsystem

The overall allocation process is described in Figure 7. The analysis begins with the collection of data about last year's programs, LEAs, and census population by county. (The data files are card files instead of tapes or disks because the small number of programs does not justify the complications of data management on tapes or disks.) The computer program is run to (1) play back the data for possible editing,

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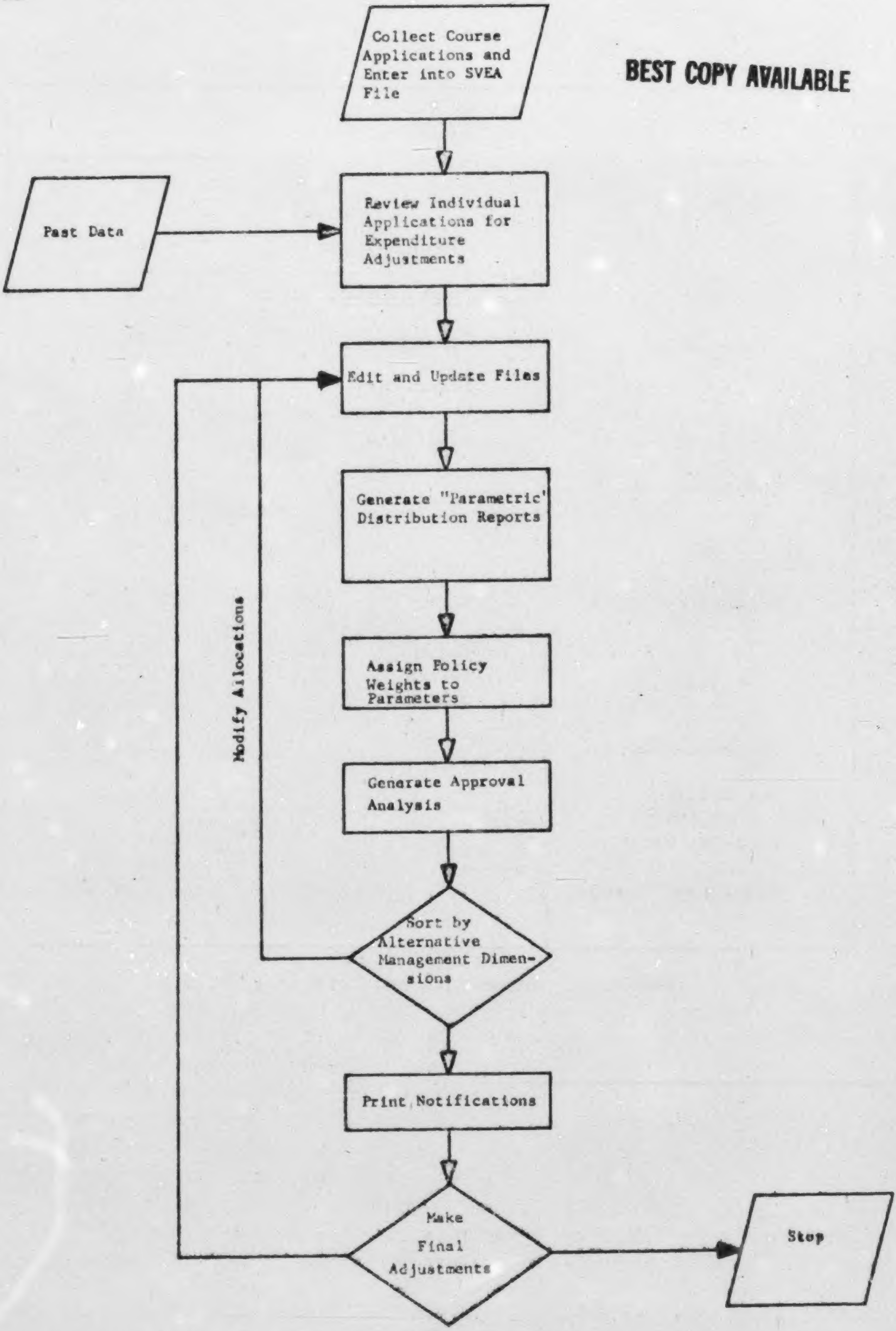
Collect Course Applications and Enter into SVEA File
Past Data
Review Individual Applications for Expenditure Adjustments
Edit and Update Files
Generate "Parametric" Distribution Reports
Modify Allocations
Assign Policy Weights to Parameters
Generate Approval Analysis
Sort by Alternative Management Dimensions
Print Notifications
Make Final Adjustments
Stop

Figure 4. Allocation Process

Course Info		Weight (Vers. 1)
Student Target	Regular	18
	Disadvantaged	12
	Handicapped	6
Course Level	Secondary	21
	Elementary	14
	Adult/P-S	7
Program Weight		?
LEA Info		
Urbanicity	Inner City	6
	Rural	4
	Suburban	2
State-Aid Category		1 - 10
Tax Effort		1 - 10
Drop-Out Rate		1 - 10
Model City Status		1 or 0

Figure 5. Parameters and Version 1 Weights

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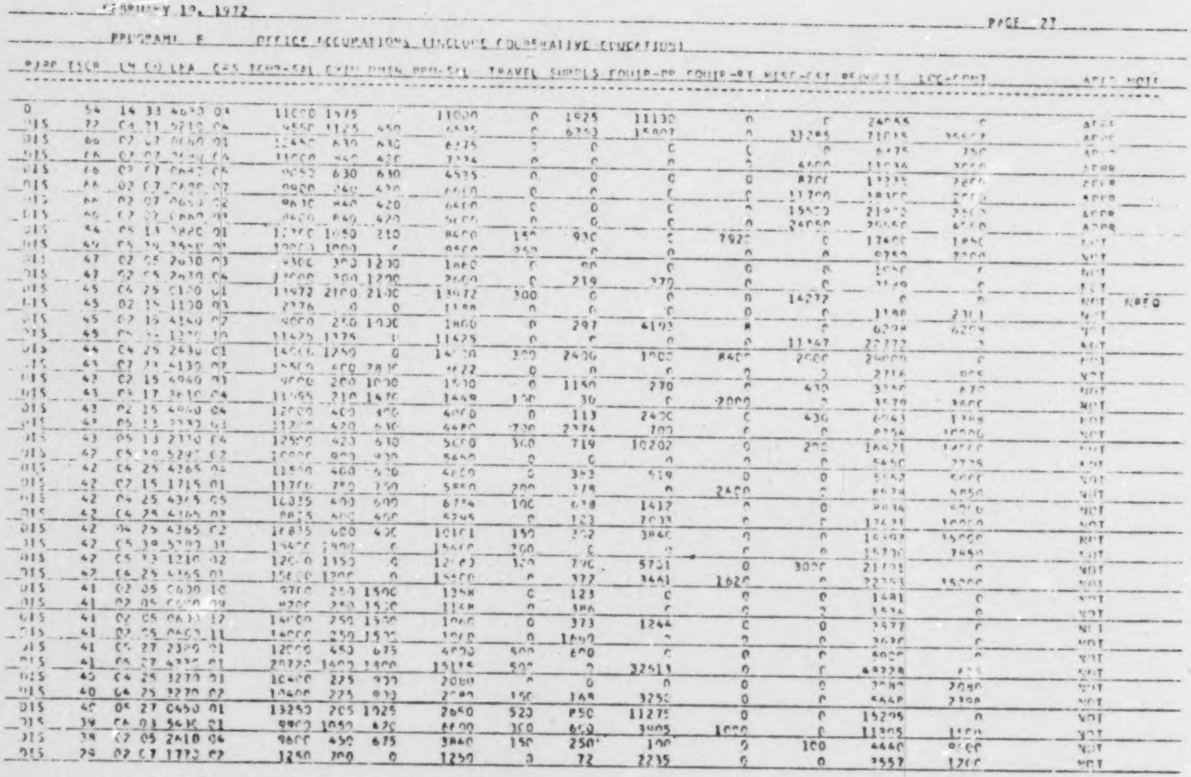

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FEBRUARY 19, 1972                                                        PAGE 27
PROGRAM: F     OFFICE OCCUPATIONS (INCLUDE COOPERATIVE EDUCATION)
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Figure 6. Excerpt From Report on Approvals by Program

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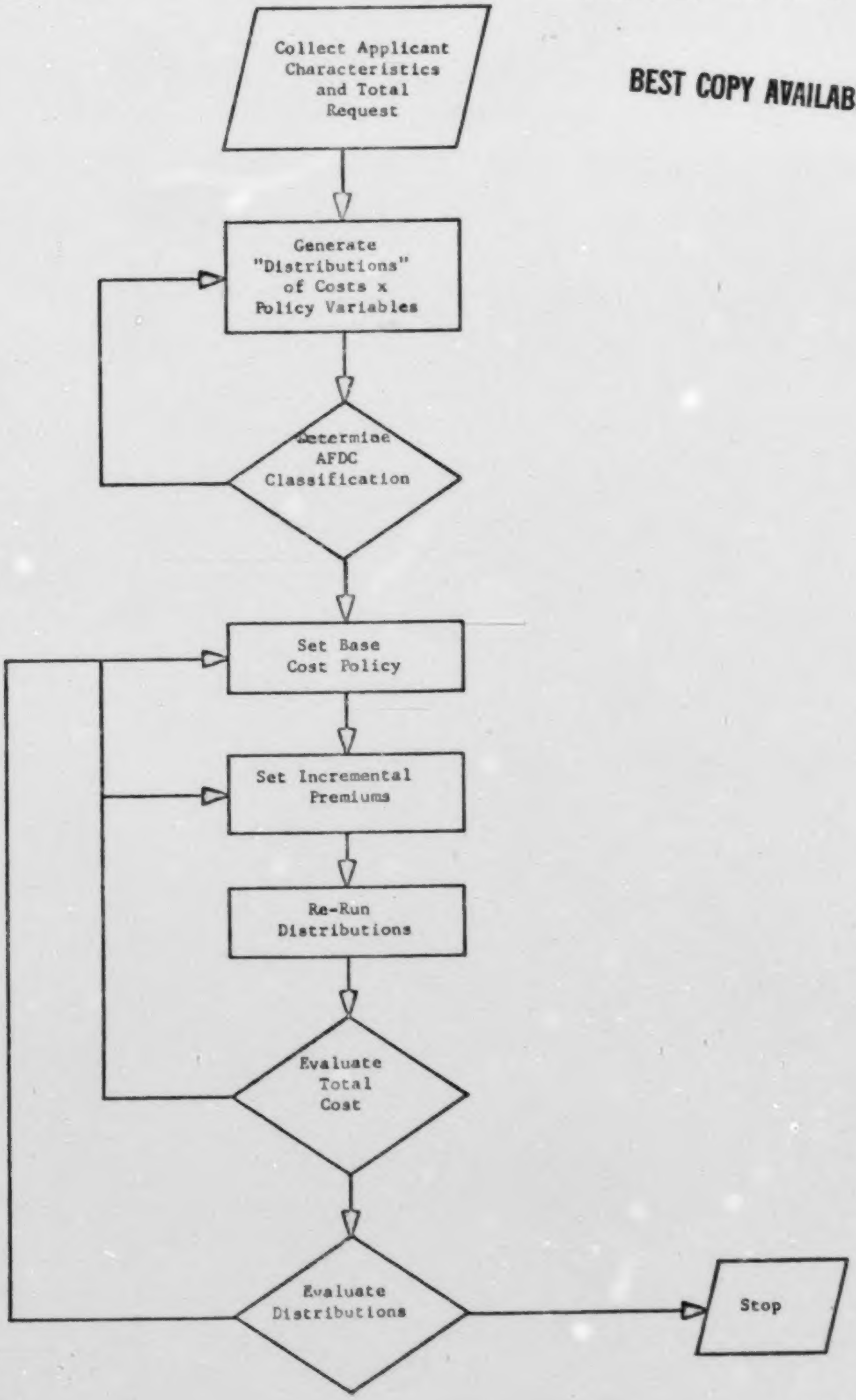
Collect Applicant Characteristics and Total Request
Generate "Distributions" of Costs x Policy Variables
Determine AFDC Classification
Set Base Cost Policy
Set Incremental Premiums
Re-Run Distributions
Evaluate Total Cost
Evaluate Distributions
Stop

Figure 7. HSE Allocation Process

(2) produce overall reports on last year's programs, actual enrollment, total expenses and cost/hour by LEA type and Evening High School versus Learning Center, (3) compare actual enrollment with population 18 and over by county, and (4) compute the actual cost/hour by program. These reports permit an analysis of whether any program is out of line in its cost/hour and whether there are significant cost differences by LEA type and by Evening High School versus Learning Center. An analysis of the extent to which potential students are being served is aided by the comparison of actual enrollment to population 18 and over.

The analysis continues with a computer run to calculate the distribution of the number of LEAs by families receiving Aid to Families with Dependent Children per 1000 population. The AFDC/1000 population is a measure of the poverty of an LEA. The first policy decision of the resource allocation process is to classify non-institutional LEAs into poverty categories using ranges of the AFDC/1000 population. Given a poverty classification, another computer run is performed to play back the classifications of individual programs and to produce overall reports on programs, actual enrollments, expenses and cost/hour by poverty classification.

The analysis of last year's and current year's relative distribution of programs, enrollments, and funds and cost per hour by all the factors (LEA type, English-Spanish, etc.) are the preparatory basis for the cycle of proposing and testing the resource effects of alternative sets of funding policies. A set of funding policies consists of a base cost/hour and increments (or decrements) from the base by factor (LEA type, English-Spanish, etc.). For example, a set of funding policies might be: base $1.00/hour, + $.50 for colleges, - $.25 for state institutions, + $.50 for Spanish, + $.30 for Learning Centers, and + $.50 for 4th- and 5th-degree poverty on the AFDC/1000 population classification.

The next computer run applies the proposed alternative funding policies to the individual programs to calculate next year's cost/hour for each program. The total cost of each program is calculated, and the state share and local share are pro-rated. Required state allocation, local share, total cost, and cost/hour for the individual programs and overall reports by all the dimensions are produced.

For any given proposed alternative set of funding policies, analysis of acceptability proceeds from the top down. First, the total feasibility is assessed. If the total state funds required exceed the total state funds available for HSE, another alternative set of funding policies must be proposed. If total feasibility is achieved, the relative emphasis of funds across all the dimensions (LEA type, English-Spanish, poverty, etc.) is examined. If any dimension has an unsatisfactory distribution of funds, another alternative set of funding policies must be proposed. If total feasibility and satisfactory distributions on all dimensions are achieved, state allocations and local shares for individual programs are examined. If any program has an unsatisfactory state or local share, another alternative set of funding policies passes all the tests, it is adopted and the state allocations and local shares of individual programs are communicated to LEAs. As in the vocational education allocation subsystem, though, there may be further negotiation of the amounts, particularly when there is a radical change in the level of funding in a given community.

General Discussion and Critique of the Subsystems

Systematic resource allocation of the kind described here is not costly if one does not consider the costs of data generation and management, which properly belong to the ongoing operational costs of the program and not to the resource allocation process. Even so, it may be too costly if it has no perceived benefit to the user. It may be very expensive if it is perceived as having negative effects.

The essence of formal resource allocation is the overt expression of policy preferences and assumptions. Aside from allocating resources, a principal benefit of such an analysis is that it helps to crystallize and make public the policies, prejudices, and ambitions of the administrative agency. Indeed, decision-makers learn about their own beliefs by being obliged to make these explicit inputs to the models. It is precisely this aspect--the making formal of assumptions and values--which most disconcerts some users. In a few cases, the motives of the manager cause him personal embarrassment. In most cases, though, managers are merely using the vagueness, duplicity, evasiveness, and "fudging" which are so useful in managing conflicts and keeping peace. It's much easier to talk about priorities than to convert them into specific allocation weights. Thus, formal resource allocation, like other decision technologies, tends to be counterproductive in political conflict-management, and while the systems consultants may be contemptuous of political realities, the SEA decision-maker can never be.

INFORMATION FOR PUBLIC EDUCATION: WYOMING'S FINANCE SUBSYSTEM

MARK M. FOX

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OVERVIEW OF THE TOTAL MANAGEMENT INFORMATION SYSTEM

Decision-makers, be they educators, businessmen, legislators or whoever, recognize the need for timely, accurate and relevant information upon which to base their actions for the present and the future. Bits and pieces of information relative to education have been available for years upon years and supplied by a number of local, state, and federal agencies. It has only been fairly recent that educational agencies have affixed acronyms to practices for collecting and dispensing information with such titles as: BEDS, EDS, GEIS, and MIS. All of which profess to be system approaches to collecting data.

Historical Development

A study completed in 1970 for the project Improving State Leadership in Education addressed itself to a series of questions related to state education agency development and utilization of information systems and planning-programming-budgeting-evaluating systems (Bliss, 1971). Forty of the 46 states reporting indicated the availability of computers and accessory equipment for processing information, but only 21 agencies indicated the existence of a full or partial Management Information System (MIS) within their agency. With the assistance of USOE, the National Center for Educational Statistics, the Council of Chief State School Officers, University Research Centers and private consultants, state education agencies are currently putting greater emphasis on the design, development and implementation of systems for providing educational information.

Whether an informational system is called a General Information System (GIS) or a Management Information System (MIS) is of little concern. What is important is the quality of the information provided to the level of management using the system. The national system for data collection may be viewed as an MIS for management at that level, but the same system may be only a GIS for management at the state or local level, and so on down the levels of information systems. Some commonality of data may be achieved at the various levels of systems, but each system must be designed to provide the information which users at the respective levels feel necessary for their decisions.

The overriding and most difficult problem which confronts any level of management in any agency is resolving the questions. What do we want to know? What data elements are necessary for the decisions to be made at the particular management level?

State agency management is right in the middle of the predicament. Not knowing what data to collect to answer questions coming from federal agencies, elected federal and state officials, managers of state agencies, individual citizens and, most importantly, the local educational agencies complicates the development of an effective system. Should the state become a vast reservoir of bits and pieces of data to provide responses to questions received from all directions? Or, should the state strive to create a base data system to meet its level of management needs? Decisions at the state level of management must first take these two questions to task and then move into the more complex question: What data elements are necessary for its information system?

Financial data or elements for a financial system probably provide the easiest base upon which to develop a subsystem within a total system of information. Dollars provide a common and defined unit of measure which tends to present fewer problems to the subsystem development than subsystems dealing with pupil, personnel or school programs.

Financial reporting by the various levels of government provides one of the oldest means for relating information about public education. Coupled with general school enrollment figures, costs for public school education may be dug out of the archives of school board minutes, state annual and biennial reports, and national registers. Legislation and regulation have mandated over the years a prudent control and accounting of public school dollars. Refinement of financial data and integrating a financial data system with other data collections, e.g., personnel, facilities, programs, pupils, etc., are the current challenges of the systems approach to educational information.

The design of a financial system, or subsystem if viewed as a component of a total informational system, is faced with answering the haunting questions presented all systems: Who wants to know what? What is it they want to know? Knowing the answers to these questions, the mechanics and modern technology can take over to input, store, manipulate and output information. Current users of financial information are not satisfied with general answers such as it costs $1,000 per year to educate a pupil, or five percent of the expenditures budget was spent for capital outlay. Current questions tend toward: What does it cost for preschool programs? What does it cost to educate a junior high pupil? What does it cost to provide a student with a salable skill in auto mechanics? How much does it cost to educate pupils with learning disabilities? In addition to these types of questions, the more complex questions of "what if" are arising. What if more dollars were put into occupational education or special education programs? Would the end result be better than what we have at present?

One of the challenges to the National Center for Educational Statistics is to come up with a system to answer the myriad of questions by providing a common base of data which effectively communicates to the various publics. The U. S. Office of Education and other organizations have been interested in creating a "common core of data" of public educational information. During 1972, the USOE awarded four grants to state agencies to define state-level user requirements for the finance module of the common core of data (Wallman, 1972). The state agencies were not obligated to adopt common data collection practices but to indicate their respective approaches to the problem and provide direction for the resolution of a common core of data.

The Rhode Island Department of Education, utilizing the contracted services of the Computer Center of Rhode Island Junior College, in addition to state and local officials, recommended a financial data system designed along the lines suggested by USOE Handbook II, Revised, and related to the program-oriented system of reporting adopted by the state for higher education (RIDE, 1973).

The New York State Department of Education study conducted with the assistance of the Riverside Research Institute approached the problem by identifying objectives to determine whether a common core of data exists or could be produced and also attempted to define the idea "common core of data." The usefulness of a common core was questioned:

> Therefore, it is clear that regardless of how many shared raw data elements exist among all LEAs the pool of common raw elements is functionally insufficient to fulfill reporting requirements. Even if the application of power coercive techniques were successful and LEAs collected information on mandated information elements to satisfy state and federal reporting requirements, there still might be too small a number of shared raw data elements to always fulfill state and federal reporting requirements (NYSDE, 1973).

No recommendations were proposed at this phase in the study for the elements of a new or different financial subsystem.

The Michigan Department of Education relied heavily on informational needs of SEA personnel to identify and rank "major-management and policy questions" and obtained 111 major questions presented by the information users (MDE, 1973). Thirty priority questions were identified to be tested against preset data collection and to determine common linkages between the questions and a common core of data. The study also revealed the most needed data that are not presently available are in the area of cost-effectiveness and program level accounting.

The Texas Department of Education began implementing a program-oriented accounting system in 1970 with plans for all districts to be on the system by 1979 (TEA, 1973). The system is designed to support long-range planning by the concept of PPBES but permits flexibility for small districts to evolve gradually into the more complex requirements of the PPBES process. A program structure for budgeting, accounting and reporting, which is similar to USOE Handbook II, Revised, is in operation. The study emphasizes that strict adherence to the definitions of functions, programs and objects is essential to the data system.

Two recent publications, similar in recommendations and funded by the USOE, indicate the trend to a financial subsystem which emphasizes the program-oriented mode of budgeting, accounting and reporting.

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An extensive study conducted by the Research Corporation of the School Business Officials does not identify or recommend a specific finance subsystem for a total informational system, but it does provide details for implementing a long-range planning system (PPBES) from which a supporting financial data system could be developed (Curtis, 1971). The Financial Accounting Manual, distributed by the Office of Education during the fall of 1973, is a revision of Handbook II of the State Educational Records and Reports Series. It outlines a structure for funds, objects, functions, operational units, programs and job classifications (USOE, 1973). This manual, if adopted by federal, state and local agencies, will provide more specific and comparable financial data than previously supplied via the function method described in old Handbook II.

Organization and Design

Wyoming's Management Information System and specifically the financial subsystem is an outgrowth of two studies conducted for the Department of Education. During 1971, a study conducted by the ARIES Corporation of Minneapolis, Minnesota, provided direction and recommendations for the organization of a management information system utilizing five basic subsystems; personnel, program, pupil, facility and finance. A second contract with the accounting firm of Peat, Marwick, Mitchell and Company provided assistance to the Department for implementing a program-oriented system of budgeting, accounting and reporting which was initiated in all Wyoming school districts beginning with the 1973-1974 school year.

The responsibility to coordinate the effort of the contractors and to assist in the design of a system was assigned to the Division of Planning, Evaluation and Information Services of the Department of Education. The primary functions of this division are to assist local school districts with long-range planning and program evaluation and to provide information relative to education in the state. The director of the MIS unit is responsible to the division superintendent and has a staff consisting of a systems analyst, two computer programmers, and two clerks. Through the state-owned and state-operated Centralized Data Processing Center, two IBM computers (360/30 and 370/155) provide adequate capacity for work presently performed and work planned in the future.

Three of the five subsystems are currently operable and in various stages of productivity. The personnel, program and finance subsystems are collecting, storing and reporting data received from local education agencies. Plans call for initiating data collection for the pupil and facility subsystems during 1975 and 1976.

Three basic objectives were adopted for the development and design of the informational system. They were:

1. to collect data uniformly and systematically from all local education agencies,

2. to limit the quantity of data collected from LEAs and improve the quality of data collected, and

3. to develop a system which will enable the state agency to assist local agencies in the process of long-range planning.

Designing a system to collect all data elements requested on federal reports was perceived as being impractical. However, reference to the USOE Records and Report Series publications during the design period has enabled the state to maintain limited compatibility with USOE reporting requirements.

The five subsystems, when fully developed and working as a single system, will serve the operation and leadership functions of the State Department of Education. Data from the system will be available for the operational-type questions directed to SEA officials, and the system will provide the SEA staff members with a communication tool to work with local school districts.

Overview of Wyoming's Finance Subsystem

Prior to 1973, the collection of financial data from public schools was structured on the functions and line items described in USOE Handbook II. Local school districts reported annually their revenues and expenditures of their general operating fund. The Department of Education tabulated the information and produced general statistics. No ability existed within the system to identify costs related to specific educational programs or describe the entire financial picture of the revenues and expenditures available to local agencies.

Objectives

Revision of the financial system began in 1972 with the adoption of a goal by the State Superintendent of Instruction to implement a program planning, budgeting and reporting system. The objectives established by the contractor and the MIS unit for the subsystem were:

1. to provide a system of budgeting, accounting and reporting which related directly to the educational programs conducted in Wyoming schools;

2. to require fund budgeting, accounting and reporting of all monies available to school districts;

3. to implement accepted accounting principles including double-entry bookkeeping and balance sheet reporting; and

4. to provide a budgeting and accounting structure to be utilized by local districts for long-range planning, i.e., concerns analysis, goal identification, objective establishment and alternative analysis.

Organization

The budgeting and accounting practices adopted to support the new financial system were modeled on evidence and effort to revise USOE Handbook II. Program-oriented budgeting was the effort being displayed by the USOE, Chief State School Officers and the American School Business Officials Association. Thus, it appeared that any system which was to have compatibility with the national system and still provide direction for local systems would have to be designed around program orientation.

The basis of Wyoming's financial subsystem is the budgeting and accounting requirements established by the Department of Education for local agencies. With the effort of the accounting consultant, local "pilot" agencies and SEA personnel, the system was designed utilizing the program structure illustrated in Appendix A. The structure was designed primarily to serve the general operating fund of the LEAs, but all funds were to use the same format. It was evident during the planning that special revenue funds (federal) never found their way into the reporting process for listing revenues and expenditures spent locally and at the state level. Thus, all funds were required to adopt the same program format.

Operational Description of the Subsystem

Present requirements of the state call for budgeting and reporting through Level IV of the structure. This enables the state to obtain costs from 20 program areas. LEAs are encouraged, but not required, to extend their accounting down to Level VI and cost out the secondary program into the 22 curricular subject areas identified by USOE Handbook VI. A number of the larger school districts are extending their accounting to Level VI during the first year of operation.

The second dimension of the program budgeting process is the accounting for expenditures through the adopted objects of expenditures, Appendix B. All expenditures are assigned to a respective object and posted to the program area which created the expenditure. This enables each of the 20 programs to reflect all expenditures for their respective operations.

Programs identified under the instruction function are to be charged with the objects of expenditures applicable to the process of learning and teaching which occurs in the classroom situations.

Administrative costs, i.e., principal and clerical expenditures and other non-instructional services, are eliminated from the cost of these programs. This enables the program to reflect an accurate cost of the direct learning process. Prorations of indirect costs for instructional support, general support and community support services may be applied to the instructional program costs at the end of a fiscal period.

Data for the financial system come from two instruments, the Annual School Budget and the Annual District Report. Data elements obtained from the Annual District Report are filed in the Finance Subsystem illustrated by Appendix C. Pupil and personnel counts provide the bases for calculations against funds, revenues and expenditures by programs and objects. Computer printouts of the data tabulated are provided to each school district, and summaries of the district and state financial data are published at the end of the fiscal year.

Combining the funds available for education within districts and the state (Appendix D) provides a more complete picture of the program costs. Each fund may be evaluated by obtaining costs per pupil served and the total cost per pupil of all funds. This type of comparison may be used by SEA personnel to analyze the extent of effort being applied in local educational agencies.

The finance subsystem will continue to be modified to meet SEA and LEA needs, but revisions or additions to the subsystem will be judged on the quality of information to be added rather than the quantity of information desired.

General Discussion and Critique of the Subsystem

Questions presented to information systems appear to fall into two categories--the comparative or regulatory questions and the planning of "what if" questions. National, state and local agencies have been required to respond to comparative questions presented by legislators, school board members, and public examiners on the costs of education at their level of responsibility. Consequently, the necessity for presenting financial data in a uniform method exists for all agencies. The planning questions call for information and responses that are dependent upon local values, needs and resources. Information to assist in answering questions of this nature becomes more complex, and uniform variables of comparative data collection are not effective for the differences existing in local educational agencies.

National, state and local agencies are providing financial information to meet the comparative questions, and it is evident that the trend for comparative data is becoming more cost-accounting oriented. This practice of cost accounting by programs will provide a better communication tool for the educational agencies, and by having such tools, more effective decisions may be reached at the various levels of government.

The heart of the total educational system remains the local education agency, and it is here that the hard decisions must be reached for the utilization of resources to benefit the pupils. Local agencies may best be served by the state agency with information on methodology and processes for identifying local needs and how to relate information that will contribute to decisions which they must make.

Wyoming has implemented a financial budgeting, accounting and reporting system which will provide administrators, board members and communities with more information on how taxpayers' dollars are being used and, to some degree, with what intent. The financial subsystem is not just a repository for all the bits and pieces of information; the subsystem will mesh with long-range planning efforts adopted by the Wyoming Department of Education.

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APPENDICES

APPENDIX A

WYOMING BUDGETING, ACCOUNTING, REPORTING PROGRAM STRUCTURE

WYOMING
Budgeting, Accounting, Reporting

PROGRAM STRUCTURE

CODE	LEVEL II Functions	LEVEL III Programs	LEVEL IV Sub-Programs	LEVEL VI Course
1000	INSTRUCTION			
1100		General Instruction		
1110			Elementary School (K-6)	
1130			Secondary School (7-12)	Coding 01 to 22 for the basic Curriculum Area identified in USOE Handbook VI
1140			Pre-School	
1200		Special Instruction		
1210			Exceptional Programs	
1280			Homebound	
1290			Other Special Programs	
1300		Continuing Instruction		
1310			Adult Non-Occupational	
1330			Adult Occupational	
2000	INSTRUCTIONAL SUPPORT			
2100		Pupil Services		
2110			Social/Guidance	
2130			Health/Psychological	
2200		Staff Services		
2210			Staff Training	
2220			Instructional Media	
3000	GENERAL SUPPORT			
3300		General Administration		
3310			Central Administration	
3320			School Administration	
3330			Business Administration	
3400		Maintenance/Operation		
3500		Transportation Services		
3600		Food Services		
4000	COMMUNITY SUPPORT			
5000	NON-PROGRAM CHARGES			

APPENDIX B

OBJECTS OF EXPENDITURES

OBJECTS OF EXPENDITURES

100 - SALARIES

Amounts paid to employees of the school system who are considered to be in positions of a permanent nature or hired temporarily, including personnel substituting for those in permanent positions. This includes gross salary for personal services rendered while on the payroll of the school district.

200 - EMPLOYEE BENEFITS

Amounts paid by the school system in behalf of employees. The amount of these benefits are paid by the employer and are not included in the gross salary of the employee.

300 - PURCHASED SERVICES

Amounts paid for personal services rendered by personnel who are not on the payroll of the local educational system and other services which the school system may purchase. While a product may or may not result from the transaction, the primary reason for the purchase is the service provided in order to obtain the desired results.

400 - SUPPLIES AND MATERIALS

Material items of an expendable nature that may be consumed, worn out or deteriorate with use, or items that lose their identity through fabrication or incorporation into different or more complex units or substances.

500 - CAPITAL OUTLAY

Expenditures for the acquisition of fixed assets or additions to fixed assets. These expenditures may be for land or existing buildings, improvements of grounds, construction of buildings, additions to buildings, remodeling of buildings, initial equipment, additional equipment, and replacement of equipment.

600 - OTHER OBJECTS

Amounts paid for goods and services not otherwise classified above. This includes expenditures for the retirement of debt, the payment of interest on debt, payment on insurance and judgments, and the payment of dues and fees.

700 - TRANSFERS

This object category does not represent a purchase; rather it is used as an accounting entity to show that funds have been handled without having goods and services in return. Included here are transactions for interchanging money from one fund to the other.

APPENDIX C

FINANCE SUBSYSTEM - DATA

FINANCE SUBSYSTEM - DATA

FILE

Fund: 10 - General; 20 - Special (Federal); 30 - Trust
40 - Bond/Int.; 41 - Special Building; 50 - Construction
60 - Food; 70 - Pupil

General

County: Name - Number - Code
District: Name - Number - Code
Organization: Unified - Elementary - High School
Valuation: District Property
Mill Levy: State - County - School District
CRU's: Elementary - Secondary - Occupational
Special Education - One Teacher (Rural)

Pupil/Staff

Code	Programs	Pupils ADM/FTE	Personnel Prof./Class
1110	Elementary (K-6)		
1130	Secondary (7-12)		
↕	(19 Programs Listed)		
4000	Community		

Revenue

Source: Local Receipts - Coded 81000 - 81999
County Receipts- Coded 82000 - 82999
State Receipts - Coded 83000 - 83999
Federal Recpts.- Coded 84000 - 84999

Expenditures

Code	Programs	Program Cost	Object Costs						
			100	200	300	400	500	600	700
1110	Elementary (K-6)								
1130	Secondary (7-12)								
↕	(20 Programs Listed)								
5000	Non Program								

Balance Sheet

Assets - Coded 91000
Liabilities - Coded 92000
Equity - Coded 93000

APPENDIX D

REVENUES AND EXPENDITURES

	GENERAL OPERATING FUND	FEDERAL FUND TITLE I	FEDERAL FUND TITLE VI	FEDERAL FUND PL 90-576	TRUST FUND (Identify)	TOTAL FUNDS
REVENUES						
Local						
County						
State						
Federal						
Total Revenues						
EXPENDITURES						
INSTRUCTION						
Elementary						
Secondary						
Preschool						
Exceptional						
Homebound						
Other Special						
Adult Non-Vocational						
Adult Vocational						
INSTRUCTIONAL SUPPORT						
Social/Guidance						
Health/Psychological						
Staff Training						
Instructional Media						
GENERAL SUPPORT						
COMMUNITY SUPPORT						
NON-PROGRAM CHARGES						
Total Expenditures						

PUTTING IT ALL TOGETHER

JOHN W. STRUCK

For the past two and one-half days we have all been participating in a conference on Management Information Systems for Vocational Education. In a time of changing concepts and educational needs, new programs for planning and leadership at the state level are imperative. The effectiveness of the state education agency depends on the establishment of a sound philosophy and clearly defined goals of leadership and service, which can be attained by SEA personnel through a combination of four basic structural factors:

1. an effective organization within the state agency;
2. a plan of communication among federal, state, regional, and local educational agencies;
3. the development and implementation of information systems; and
4. a system for equating resources with program effectiveness.

One issue currently hampering the effectiveness of state educational agencies is the lack of adequate information required for the agency's planning and leadership functions. Educational planning today is viewed as a means of achieving the short- and long-range goals of the institution. Educational planning is the process of determining goals and objectives, obtaining and analyzing pertinent information that brings into focus present and emerging problems and needs, obtaining agreement on procedures and activities designed to meet those needs so objectives can be achieved, and assessing the degree of attainment. However, if the "right" kind of information is not available, efforts to engage in serious educational planning are hindered.

The network or systems approach to planning is a major advance in improving management planning and control effectiveness. It is designed specifically to deal with the accelerated pace of today's development programs, and the uncertainties associated with them. The decision-making process requires increasing amounts of data of all kinds, both qualitative and quantitative, with the result that it has been necessary to look for new aids to sound decision-making. Although no management tool in itself can make decisions, some of the tools of network planning can provide the basis for a realistic and economical management information system which will permit more informed decisions to be made.

I use the term "management" instead of "administration." This is because the trend in school administration is toward more informed decision-making on the part of school officials rather than just the maintenance and operation of an existing organization. Many feel that decision-making is synonymous with managing. It is the purpose of network management systems to supply information to the manager in a timely, useful, and understandable manner.

There are, in general, three kinds of management information systems: product related, operations related, and administration related.

In general, management information systems in education are administration related--that is, the systems involve non-technical information related to providing the organizational, financial, manpower, material, and facilities resources needed to carry out the functions of education at the appropriate time and place and by the appropriate methods.

We have been discussing at this conference various techniques for gathering and summarizing data. It would be redundant of me to summarize the papers which were presented. Instead, I want to challenge you through a discussion of available techniques for using the data for educational management and to kind of "put it all together."

I have the strong feeling that because of many factors, most of us have been hard at work developing systems to collect data of all kinds, and then just hoping and assuming that others on our SEA staffs and the vocational administrators in LEA's do something useful with the information provided.

To "put it all together," management tools must be applied in order to gain the greatest benefit from our data. So, I raise the question of how much effort we are putting into using the data and information provided by our collection systems.

Network management tools have evolved from a number of much simpler procedures. Although these have been used in industry, engineering, and the military for many years, they are relatively new to education.

One of the oldest of these techniques is the Gantt chart, which was invented by Henry Gantt aroung 1900. The Gantt chart is a series of bars plotted against a calendar scale. Each bar represents the beginning, duration, and end in time of some segment of the total job to be done, or activity to be accomplished, and together the bars make up a schedule for the whole program.

While the Gantt chart is a useful tool for gross planning, it does have a number of weaknesses. The chart cannot show interdependencies among activities; it is inflexible and cannot reflect changes in plans or "slippages" in the system; and it is unable to reflect uncertainty or tolerances in the duration of the estimated times. However, it is a considerable improvement over the mere listing of activities which often constitutes the total management plan of a project or a program.

An improvement over the Gantt chart was the Milestone Chart, which specifies the key events or points in time which can be identified as the program progresses. It is oriented to events rather than to the duration of activities. In milestone charts, the lists of tasks and milestones are displayed on charts adjacent to a time scale. The milestone chart has been used extensively in the military and industry for the management of major weapon systems programs prior to the advent of PERT.

Even though this was an improvement, there were some limitations, notably the fact that the relationship between milestones was still not established. Milestones were listed in chronological sequence, but not related in a logical sequence, and there was no display of interrelationships.

Although computers could be used for sorting and listing information on milestone charts, they were not used as effectively as might be until the advent of PERT and CPM. In 1957 the DuPont Company began an investigation of the extent to which a computer might be used to improve the planning and scheduling, re-scheduling, and progress reporting of the company's engineering programs. This resulted in a system known as the Critical Path Method, which used a unique arrow diagram, or network, method.

At the same time, the Special Projects Office of the U. S. Navy was faced with the management of the POLARIS--a huge, complicated weapons system development program, which was conducted at or beyond the state of the art in many areas, with activities proceeding concurrently in hundreds of industrial and scientific organizations in different areas. What emerged was the Program Evaluation and Review Technique PERT, which was an integrated management planning and control technique.

It is important to notice some differences between these two techniques. In general, CPM was developed when the elements were:

1. well defined projects,
2. one dominant organization,
3. relatively small uncertainties, and
4. one geographical location for a project.

CPM, which is an activity type network, has been widely used in the process industries, in construction, and in single project industrial activities.

The PERT network (event network) evolved from a combination of bar charts and milestone charts, on which milestones were identified as special events, or particular points in time, which were of interest to management. The environmental factors were considerable different from those which influenced the development of CPM:

1. massive programs with hard to define objectives
2. multiple and overlapping responsibility divided between organizations
3. a large degree of time and cost uncertainty
4. wide geographical dispersal and complex logistics

The PERT technique has proved most applicable to large-scale research and development, in systems engineering programs, and in other industrial activities involving a large degree of uncertainty, such as new product development and marketing.

It can be useful to construct PERT diagrams in order to be able to allocate resources to the best advantage.

An example is in the development of new materials for a program which must also include teacher inservice and testing out in the classroom. A PERT chart can show the interrelationship among the planning and development activities, the secretarial services needed, the use of consultants, and the building of facilities or the production of materials in quantity. A good analysis, for example, may reveal the fact that a given objective cannot be accomplished in the time that was anticipated unless additional clerical help is provided at a certain time. Since the activities needed to accomplish the events can also be tied to costs, alternate solutions or strategies can be PERT-ed to show the relative feasibility in relation to cost of various strategies.

An important concept in PERT is that it is possible to define the critical path--that is, to find the path among all of those in the network that will consume the most time in reaching the end event. By isolating this particular sequence of activities, the manager derives some of the most vital information he needs to plan and manage the problem properly. The network also is able to handle uncertainty in the program plans because it estimates a range of duration times from the most optimistic to the most pessimistic for each activity in the network plan.

The use of PERT is valuable as a management information system because it controls the quantity, type, and format of vital information needed for the manager from one program level to another. The PERT network can and should be modified as slippages and changes occur in the duration of the activities leading to the events. Information from the network can then be used to make decisions regarding when resources will be required and how resources might be reallocated if necessary to best achieve the objectives.

In systematic planning for any network system, however, these questions should be answered:

1. What are the project objectives?
2. What are the major elements of the work to be performed, and how are these elements related to one another?
3. Who will be charged with the various responsibilities for accomplishing project objectives?
4. What organization of resources is available or required?
5. What are likely information requirements of the various types and levels of management to be involved in the project?

Decision Trees and Fault Tree Analysis

While the network tools I've been discussing apply particularly to project planning and development, an increasingly important use of network planning techniques, both in industry and in education, is in the evaluation of existing systems and procedures, with a view to monitoring and possible redesign. These techniques are extended to introduce structure and logic into the decision-making process and to assist managers and policy-making bodies in making long-range choices from among alternatives.

One such tool which has been used effectively in industry is the Decision Tree. This is used when an organization must make decisions about future plans based on incomplete information. The theory is that no decision operates in isolation or even under a simple sequence. It is assumed that any decision made at any time will be influenced by events that have happened in the meantime, and that it is possible to anticipate a number of alternative results at each decision point based on varying events.

A simplified decision tree can be drawn to show the alternatives concerning whether a cocktail party should be held indoors or out. There are two choices possible: to hold it outdoors or to hold it indoors. There are two possible weather events to take into consideration also: rain and no rain. The results of each of these events as related to each of the two choices can then be depicted.

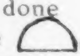
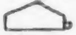
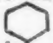
Decision trees have not been widely used in education, but the technique offers many possibilities when used with MIS. For instance, a decision tree might be built to anticipate the results of building two different types of high schools in a school district: (1) a third comprehensive high school in addition to the two which are presently existing, and (2) a vocational-technical high school.

The decision on which school is to be built can then be based on the analysis of such data as the percentage of pupils who have exited from the high schools directly into the job market within the last five years from that district, the relative costs of the two schools, the cost of vocational programs in comprehensive schools as compared with vocational schools, the character of the population and analysis of population trends for the area, and the relative probabilities of high, medium, and low average demands for vocational-technical education. By analyzing the impact of various future events on each type of school in various stages of time and at given decision points, decision-makers can make more informed judgments regarding the type of school to be built. Also involved, of course, are qualitative judgments having to do with values related to the tracking and academic segregation of students and other matters which do not relate to costs in the financial sense. The impact of these can also be charter, however, and should certainly be taken into consideration in future planning.

As Peter Drucker has expressed it, "Long-range planning does not deal with future decisions. It deals with the futurity of present decisions." In other words, today's decision should be made in the light of the anticipated effect which it and the outcome of uncertain events will have on future values and decisions! Industry has combined the use of decision trees with forecasts of demands, market analysis, and financial and other evaluations of programs in order to provide more objective data to evaluate alternatives. Perhaps far greater use of this method should be made by educational administrators.

The final network concept I wish to present here, which is related somewhat to decision trees, is that of Fault Tree Analysis (FTA). Fault Tree Analysis is a technique for increasing the probability of success in any system by analyzing the most likely modes of failure that could occur. It is an operations research tool which has been used with signal success as the principal analytical tool of systems safety engineering on aerospace projects.

The fault tree was so named because the completed graphic portrayal of a functional system utilizes a branching process analogous to the development of a coniferous tree. The undesired event is located at the apex, and the various contributing events are the branches that extend outward and down. A fault tree, also called an "event logic network," provides a concise and logical step-by-step description of the various combinations of possible occurrences within a system which might result in a predefined "undesired event." It is a diagram which traces systematically the probable mode of failure leading to the undesired event, the interaction among those modes, and the critical paths.

An important function which is performed by Fault Tree Analysis is the depicting of the interrelationships among events. This is done by means of logic gates, the most common of which are the AND gate , the OR gate , and the INHIBIT (or conditional) gate  . Events are depicted by various shapes, such as rectangles, circles, and diamonds, to show the source of the event or its degree of development in the analysis.

Fault Tree Analysis provides for the analysis of possible weak points in a system by means of logic relationships. Analysis of many educational systems (programs) has shown that most of them have built-in design weaknesses--the lack of provision for alternate paths to success for students is a striking example.

The importance of making decisions through FTA is that it provides a clear indication to the educational manager of the weakest links in the system and, thus, gives information for decisions regarding the best allocation of resources. By identifying the most probable failure modes, the manager can then redesign all or part of the system for success. Critical paths in FTA perform different functions from those in PERT and CPM, but the principle of charting a clear path through complex networks of activities and events is the same.

A fault tree superficially has some of the same characteristics as a decision tree, but the use of logic gates in FTA to show interrelationships results in a different kind of analysis. FTA can be used to evaluate systems already in operation or only on the drawing board. It is valuable in the planning stages of a new program as both a design tool and to evaluate the probable effectiveness of the system once it is in operation.

In the present state of the art, it appears that FTA is a useful tool for educational planning and management in the following ways:

1. It forces the asking of those questions which identify the things that retard attainment of objectives or, worse, result in absolute failure to reach them.

2. The completed tree makes it possible for expert judgment to be brought to bear on one portion of a problem at a time. Perhaps most important, it shows the _interrelationship of all elements in the program in a systematic way_, providing information to teachers, principals, superintendents or school boards, of a type and in a form which can provide a rational basis for decision-making.

3. Since a good tree has predictive value, it permits redesign of new programs or the building-in of safeguards before the program is put into operation.

4. It can also provide continuing evaluation of a program in operation, thus signaling the need for correction to prevent failure.

5. Its greatest value lies in its use as a planning and design technique. When properly implemented, it can assist instructional planners and educational researchers to discover the most probable weaknesses in a plan, and thus provide data for decisions regarding the allocation of resources for the improvement of the system. Most evaluations of new programs are concerned mainly with "products" of a change. Fault Tree Analysis also provides for "process" evaluation and is, thus, particularly applicable to field studies.

6. It enables the educational manager to analyze opinions, value judgments, and philosophical statements of _events_, thus providing a more logical basis for decision-making.

Relationship of MIS to PPBS, PERT, Decision Trees, and Fault Analysis

It is apparent that the organization and retrieval of information is at the heart of all systems approaches to educational administration, planning, and evaluation. The management information system constitutes the core of PPBS. As a management tool, network procedures such as PERT and CPM rely heavily upon the storage and retrieval of pertinent information, regardless of whether computers are used in the process or not.

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Decision trees use information on present and (probable) future states to predict the results of alternate solutions to problems.

Likewise, Fault Tree Analysis is in itself a management information system, as well as being a network tool. In the case of FTA, data are gathered regarding the probability of occurrence of the "fault" events, so that a critical path may be established. If Fault Tree Analysis is conducted properly within the framework of a system approach, it gives the administrator information on those essential places within his system which should be monitored or redesigned. Onde the analysis is accomplished, and system changes are made as needed, FTA does not constitute a management tool in the same sense as PERT; but the findings can and should be referred to frequently in order to assess the system in terms of whether the requisite changes have taken place.

FTA can also serve as a kind of "early warning signal" regarding the points at which the system might break down later if it is not changed. For example, the combination of operations analysis and FTA might show that a particular program is working to capacity now in terms of the kinds of supportive services it has or the number of students it can accommodate; but if more students enter the program, it will become seriously overloaded and will break down. Thus, FTA can provide an administrator or program director with data regarding the types of information that will be most useful to gather and can indicate possible courses of action to take on the basis of the data.

Management information systems, therefore, are essential to the application of a system approach to education. The definition of the system and the use of network management tools assures that the kinds of information gathered will be those most needed for administrative decisions and that there will be appropriate analysis and interpretation of the data in order to lead to those decisions. It is obvious that this approach is a far cry from the mere collection of various kinds of data for reporting purposes or the collation of statistics. All too often, unrelated data from school systems are fed into computers, only to result in massive numbers of information documents and printouts lying on the shelves, not available or inappropriate for feedback to decision-makers. It is this kind of error that the installation of organized management information systems is designed to correct.

The State of the Art

What is the "state of the art" of MIS in vocational education? Well, much of that has been discussed here these past two and one-half days. For specific details, however, let me refer you to a find study done by Sam Bliss at Denver, Colorado, entitled The Extent and Utilization of MIS and PPBS in State Educational Agencies. Containing 31 pages, it is available from ERIC, and its reference number is ED 057 450. Here are just a few of the findings highlighted in this study:

Forty-four SEA's and two American territories provided data for this study. In general, the 44 reporting SEA's have identified and begun a planned program of activities designed to establish a general information system. However, there is considerably less activity in the MIS and PPBS development areas. There is a wide range of MIS and PPBS development considering both staff and budgets. Some SEA's reported no activity while others provided data that indicate a high level of activity over a number of years in these two areas.

It is significant to note that of the 22 SEA's reporting organizational placement of MIS development groups, all but five placed the MIS division at the assistant superintendent's level or higher, with eight reporting the MIS division responsibility at the deputy superintendent's level.

Separate organizational structures have been formed for a design division and a forms division in the majority of SEA's reporting MIS capabilities.

MIS division staffing ranges from a low of two persons assigned to a high of 40 individuals involved in the various MIS activities.

Electronic methods were reported as the most used procedure for information processing and were combined with unit record and other mechanical procedures. Only eight states reported manual information processing methods. There was considerable uniformity in equipment among reporting SEA's.

Forty of the states reported the availability of computers and accessory equipment for processing information. COBOL is, by far, the most often used programming language among SEA's.

The four main difficulties restricting MIS development that were listed by SEA's are: (1) lack of understanding and knowledge of an MIS, (2) financial restrictions, (3) lack of an appropriate planning structure, and (4) low priority for the task of designing and developing the MIS.

PPBS has been mandated within the SEA's almost equally by legislative action and by governors' orders with the initiation of the programs within the past three years. Of the 18 SEA's with initiated PPBS programs, 15 have indicated activity in most of the basic elements.

Where To Now?

I'm sure that none of us here today has a crystal ball with all the answers to the future. Here are a few things, however, that I see:

1. Considerable progress has been made by quite a few states, but relatively little exchange of information, forms, charts, and techniques has taken place.

2. The need for better accountability and more information will steadily increase in the future.

3. Interstate cooperation and exchange of system information will increase, perhaps through more frequent workshops, seminars, and conferences like this.

4. Care must be exercised not to go "overboard" in the collection of data, to the extent that we gather more than can readily be used.

5. Data collection systems will gradually become more sophisticated and automated, making it easier for both SEA and LEA officials to obtain and use information for the improvement of programs.

6. The need for both accountability and information by which educational improvements can be made will increase so rapidly that even the smallest states will need to use MIS.

7. Finally, much, much more attention needs to be paid to the development and use of Management Tools, Networks and Systems, to make full use of the tremendous amount of data and information collected.

For the past two and one-half days we have met here and discussed the pros and cons of various plans, forms, and techniques for gathering information. Many states are just on the threshold of developing and polishing a system which will quite effectively obtain for SEA's valuable data and information which might be helpful in improving many of our undertakings in vocational education.

Yet, I cannot help feeling that we are in the "Model T stages" of making this vehicle go. We are designing the parts; we are coordinating and assembling many of the units; and we've printed them up in many colors to make them pretty.

We have produced quite a bit of interesting information; yet, I'm sure that we educators are "babes in the woods" when it comes to using this material for making educational changes. Thirty-five states have developed accounting subsystems, 33 have developed subsystems on personnel, 14 tabulate space and facility information, 20 have equipment inventories, 31 collect information on budgets, and 17 states gather program information of one kind or another.

All this is interesting, useful, and potentially helpful. Yet, what educational changes have really taken place because of Management Information Systems?

I urge you--yes, even challenge you--to continue not only the fine developmental work you have been doing on information gathering systems, but to put far more efforts into applying many of the fine management tools that are available, so that we truly develop management systems and networks.

Many of the tools I have mentioned today can readily be applied to educational administration and problems, if we only try. Let's "put it all together," not drop the ball at the scrimmage line, and carry it effectively and competently all the way to the goal line.

We in Pennsylvania look forward to joining hands with you and being part of this leadership team as we all work together toward our common goals.

SUMMARIES

The following are summaries of the ten papers that are descriptive of operating systems. The summary format is a slightly reduced version of the outline in Figure 1, page 2, consisting of four headings within each paper:

1. Overview,
2. Overview of subsystem of interest,
3. Relationship of subsystem to decision-makers, and
4. Operational description of subsystem.

Category 4 of the above format collapses the "operational description" and "general discussion" sections of the Figure 1 outline.

STUDENT ACCOUNTING SYSTEMS

1. The Minnesota Vocational Follow-Up System. Dr. D. J. Pucel.

Overview. Developed from an extensive follow-up system contained in Project MINI-SCORE, the Minnesota vocational follow-up system is administratively lodged within the Department of Vocational and Technical Education, University of Minnesota.

Overview of subsystem of interest. The Minnesota follow-up system is a centralized system for follow-up data on postsecondary vocational-technical students in the state. Its objectives are to gather pertinent information on enrollees and graduates which will help decision-makers in improving vocational education programs.

Relationship of subsystem to decision-makers. The system is primarily designed to assist two groups, state department and local school personnel. Coordination, however, is maintained with a number of ancillary committees and associations.

Operational description of the subsystem. The information requirements include four instruments concerned with data on enrollment, termination, follow-up and employer perceptions, respectively. Enrollment and follow-up forms were designed so as to minimize the need for involvement of local school staffs. The termination report is completed by an institute representative. The employer questionnaire seeks information on knowledge and skills possessed by graduates, and is sent to the graduate's employer one year after graduation. The employer and follow-up questionnaires are designed to provide diagnostic feedback for program evaluation, and explore the student's reaction to the training program, his job satisfaction, and his employer's reaction to his work.

The subsystem is funded by the Division of Vocational-Technical Education, and is estimated to cost around $117,000 per annum. This figure includes all costs of gathering, processing and reporting the information. Each type of information received is combined into a composite student record. Separate reports are generated from enrollment, termination, and follow-up data with the aim of provision of information to decision-makers in November of each year.

2. Oklahoma's Student Accounting System. Dr. J. B. Morton.

Overview. Growing out of computerization of its financial accounting system and the development of OTIS. Oklahoma's vocational MIS presently has eight components, one of which is the subsystem of interest for this paper. The total MIS is supported structurally by the inclusion of the state Research Coordinating Unit within an autonomous state department of vocational education.

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Overview of subsystem of interest. The newly constituted Division of Research Planning and Evaluation within the State Department of Vocational Education has responsibility for administering OTIS, which includes the student accounting system. Its objectives are cost effective collection of enrollment, completion, and follow-up data on vocational students.

Relationship of subsystem to decision-makers. Data collected by the subsystem are of use in the State Plan and occasional reports to USOE as well as for dissemination of public information on the state vocational-technical programs. Data are also used as input into other components of the MIS, and by the state department in daily administration of the various divisions.

Operational description of the subsystem. The Research Coordinating Unit mails forms to teachers via "contact persons" at the area or local level. These are returned via the same route, checked for accuracy, and computerized. Since teachers are used exclusively as data sources for all these forms, students are sampled for follow-up information every three years. The first such study to be completed has shown no significant differences between data from the two sources.

The subsystem is funded by federal and state money through the Research Coordinating Unit budget; annual operating costs are estimated at just over $15,000. Reports generated by the system on enrollment include a summary by division and two reports to USOE. Three reports are prepared from both completion and follow-up data respectively, and the system also produces an ethnic report and a class roster.

Problems with the system are seen as centered around the return of information within the required time frame and inaccuracies encountered in the use of OPSCAN forms prompting the change to coding and keypunching.

3. The Pennsylvania Vocational Education Management Information System (VEMIS). Dr. L. E. McHenry.

Overview. VEMIS operates under the general direction of the State Director for Vocational Education, and receives technical assistance from several advisory committees from the various educational levels and institutions served by the system. A manpower conversion equation relating undeveloped human resources to skilled and unskilled occupations provided the rationale for system purpose. Objectives include growth and improvement in curriculum offerings and enrollment, upgraded skills in graduates, improvements in placement, and reduced costs per placement. The system is composed of twelve integrated subsystems, two of which are dealt with in detail in this paper.

Overview of subsystems of interest. The Student Basic Data System and the Follow-Up Survey Data System provide the Bureau of Vocational Education with aggregate data on enrollments, transfers, terminations, and evaluation of program effectiveness for secondary, postsecondary, and adult vocational curricula. The Basic Data System has as its main objective the provision of relevant information to state level vocational education management. The annual graduate follow-up survey however is geared towards identifying major weaknesses in vocational education programs.

Relationship of subsystems to decision-makers. Sensitive to information needs determined through monthly meetings of advisory committees, the systems are a source of data to a variety of users at the federal, state, and local levels.

Operational description of subsystems. Employing OPSCAN format exclusively, the Basic Data System receives student data via three instruments. The year-start roster form is provided to teachers by curriculum as a means of checking and updating continuing students. Entering students complete a student registration form. Data from these two sources are combined to provide a year-end roster to be verified by teachers. The annual follow-up survey is conducted of all students and for all levels of vocational education (i.e., secondary, postsecondary, etc.). VEMIS is funded through the state director's office under Part D monies. Annual operating costs of the two subsystems are estimated approximately at $100,000. The annual surveys produce various state management reports as well as federal feedback, and several different surveys are being conducted currently to determine, for example, geographic and occupational mobility, and program and employment problems across vocational students and graduates. System functioning appears to be better than initially expected. Traditional problems--duplicate reporting on enrollment, for instance -are largely avoided. However, some local procrastination in data collection is cited, as is system staff dissatisfaction with instability of federal support and with inappropriate time frames in federal reporting requirements.

4. VERS--The Student Accounting Component of VEMIS-V. Drs. P. S. Vivekananthan and J. D. Oliver.

Overview. Resulting from the coordinated efforts of the Virginia Polytechnic Institute and State University, the Vocational Education Evaluation Project (VEEP) was initiated in 1971. Its primary objective was the development of a Vocational Educational Management Information System for the State of Virginia (VEMIS-V). As components are designed and implemented, they come under the jurisdiction of the coordinator of vocational education research and statistical information within the State Department of Education.

Overview of subsystem of interest. Two fully developed subsystems of VEMIS-V, concerned with enrollment and follow-up respectively, make up a student accounting system known as the Vocational Education Reporting System (VERS). Its objectives are to minimize time and effort in gathering and providing accurate information on student flow for decision-makers.

Relationship of subsystem to decision-makers. Primary users of VERS are the Director of Vocational Education and his staff, supervisors of vocational services, and the State Advisory Council. Data are currently used by state staff in evaluating programs and in determining funding patterns. Plans are under way to make system information more accessible to local-level personnel.

Operational description of subsystem. Data on secondary students are collected on three forms. The student enrollment OPSCAN form elicits information from the student, but under teacher supervision. The termination or completion form is filled out by teachers, and the follow-up questionnaires are mailed to a random sample of former students from each vocational service. Routing of the forms is facilitated by reporting system coordinators in each school division in the state. Summary information is also collected on adult vocational enrollees. VERS is funded by the State Division of Vocational Education and the Division of Educational Research and Statistics within the State Department of Education. Total annual operating costs are estimated at $73,626 for processing information on approximately 300,000 students. Standard reports are presently generated annually for USOE. Reports containing information on the handicapped and disadvantaged, as on enrollment statistics, are also available for the state supervisors and the State Advisory Council.

Accuracy and relevance of information for the needs of system users appear to be satisfactory, though adjustments are being made to meet newly enacted legislation regarding state standards in quality and objectives for public schools.

MANPOWER SUPPLY/DEMAND SYSTEMS

1. The Kansas Manpower Utilization System for Training (Manpower Demand Module). Dr. J. L. Harris.

Overview. After evaluating existing MIS in other states, Kansas selected OTIS, with some modifications, as their model. Careful efforts were made to avoid duplication with already existing data sources in the state. Development was the responsibility of Kansas State University; however, control and location will eventually be within the State Department of Education. Sixteen subsystem modules are introduced and summarized, one of which is dealt with in detail in this paper.

Overview of subsystem of interest. The demand module is aimed at producing manpower needs projections by occupation for eleven regions in Kansas and the state as a whole. The system consists of a series of computer analyses of the Kansas work force in terms of historical trends.

Relationship of subsystem to decision-makers. The State Department of Education is the principal user of system output; data produced by the module is used primarily by state supervisors in deciding whether to approve vocational education programs across the state, and in long-range planning for relevant sections of the State Plan. Output from the module is also used internally as input to other K-MUST modules.

Operational description of the subsystem. Originally K-MUST elected to follow OTIS in using the employer survey method, but then moved to a modified version of the Bureau of Labor Statistics matrix method A. Demand data derived through Bureau of Labor Statistics techniques are adjusted to correspondence with State Employment Security Commission data.

Standard reports provide a comprehensive picture of manpower demand by occupation in regions across the state.

The cost for the development of the Bureau of Labor Statistics matrix approximated $12,000. Annual operating costs for the demand module amount to about $5,000. Funding comes through the State Department of Education from Part B money.

Presently it is estimated that the system meets most of the manpower data needs in the state within acceptable error limits. However the author acknowledges some lack of necessary detail in projections, as well as some management problems in obtaining financial approval for data purchased as input into the module. Minor difficulty has been encountered in identifying emerging occupations, since the system is historically data-based, and some confusion is possible between closely related occupations within clusters.

2. Manpower Supply and Demand Determination in Minnesota. Dr. M. E. Johnson

Overview. While the Minnesota MIS is within the State Division of Vocational-Technical Education, its organization is divided among four sections. One of these sections, Program Planning and Development, deals with manpower information. This section emerged out of the coordinated, though independent, efforts of the State Department of Manpower Services, the State Research Coordinating Unit, and the State Division of Vocational-Technical Education. A further separate section, also within the division, deals with manpower development and training; it is, however, predominantly concerned with the Department of Labor programs. These four sections, it should be noted, are independently managed (pp. 167-168).

Overview of subsystem of interest. The manpower information subsystem has relied upon its advanced follow-up system to provide supply data for vocational education planning, and has concentrated recently on an occupational demand information system being developed within the State Research Coordinating Unit. The objectives of this system were to establish reliable figures on the total number of employment positions in a given area (occupational demand) and the number of positions which are to be newly filled within a prescribed period of time (unfilled positions).

Relationship of subsystem to decision-makers. The above data are determined for 151 programs, primarily for consideration in preparation of the State Plan, as required by law. This information is also used to decide on marginal changes made in program offerings.

Operational description of subsystem. Methods of deriving occupational demands and unfilled positions and some of the assumptions supporting these methods are explained. The nine broadest occupational categories are used as examples. Demand estimates for a given year are presently calculated by extrapolation from a linear projection of 1968 to 1975 occupational demand provided by the State Department of Manpower Services. Replacement percentages are then computed by sex and occupation, and demand estimates adjusted accordingly to give unfilled positions.

Because of the independent nature of the functions of this system, no estimates of annual operating cost are available at this time. Output data are available on a statewide or metropolitan area basis, as well as by economic region.

While supply data have generally been considered accurate for state planning purposes, future attempts are planned to incorporate data on mobility of individuals across and between occupations. Though validity of projections is functionally related to the size of geographic area, empirical comparisons have supported accuracy to within tolerable limits.

3. Occupational Training Information System (OTIS). Dr. J. B. Morton.

Overview. Growing out of computerization of its financial accounting system and the development of OTIS, Oklahoma's vocational MIS presently has eight components, one of which is the subsystem of interest for this paper. The total MIS is supported structurally by the inclusion of the State Research Coordinating Unit within an autonomous State Department of Vocational Education.

Overview of subsystem of interest. The OTIS system arose from preliminary studies of the need for manpower information in the State of Oklahoma. The system was recommended as a means of providing ongoing information for policy and operational decisions, primarily in vocational education program planning. Its objective is the optimum balance between manpower needs and manpower training.

Relationship of subsystem to decision-makers. The OTIS publication is utilized by a wide variety of agencies and personnel across the state. Information is provided to all levels of vocational program planning, as well as to city, county and area planners outside of vocational education. State and federal legislators are also kept apprised of state manpower information through OTIS data.

Operational description of the subsystem. OTIS is an annual publication which gives gross demand, gross supply, and net demand projections on 218 occupations for the state and 11 substate planning regions. The system clusters DOT occupational codes and relates them to OE program codes, calculating net manpower requirements per occupational cluster by summing algebraically demand and supply figures. Clusters are then rank-ordered by size of positive net demand, in descending order. Sources of supply data are charted on page 195 and include the student accounting system referred to previously, as well as a number of other state and federal agencies. Demand data are based exclusively on state Employment Security Commission collection of information by employer surveys statewide.

Several agencies contributed to the original development of OTIS, and development costs are estimated to have been in the area of $200,000. Funding responsibility for current operation lies with the Information Services Unit of the State Department of Vocational-Technical Education, and the annual operating cost is just over $22,000.

OTIS projections have correlated satisfactorily with empirical data. Planners need and use OTIS demand data information concerning substate regions for adequate planning as to what program is needed and where it should be located. The firm survey technique for collection of demand data is defended, though its expense is acknowledged. Further study is needed to gather information concerning on-the-job training in the future.

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4. Manpower Forecasting in Pennsylvania. Drs. J. K. S. Senier and S. J. Franchak.

Overview. Chiefly as a result of a comprehensive study in 1967-69 of vocational and technical education in Pennsylvania, relevant public departments developed a major thrust towards systematic statewide vocational educational planning. The Bureau of Information Systems within the State Department of Education has recently attempted to unify previous efforts by beginning to establish a centralized system for the generation of manpower research and information.

Overview of subsystem of interest. To avoid duplication of effort, a common data base was developed. The selection of input data and forecasting models has made the system sensitive to various levels of detail necessary to educational planners and decision-makers. Using the individual vocational education graduate as the unit of analysis, the system has as its objective the provision of accurate manpower supply/demand information for occupational education planning. Originally the supply/demand model was based on 1960 census data. During update to 1970 data, several important improvements were incorporated into the design.

Relationship of subsystem to decision-makers. Primary use of the system has been within the State Department of Education, particularly within the Bureau of Vocational Education in preparation of the State Plan, and for providing support for local-level planning. However, the Office of Higher Education has recently shown interest in the data. Agencies outside the State Department of Education have both contributed data as input, and utilized output from the system.

Operational description of the subsystem. Current operation reflects many changes in the original system. Initial use of 1960 census data and the assumption that graduates would enter the occupations for which they were trained restricted the validity of system output for local needs. Original input sources have been incremented to include greater detail and scope in supply data (e.g., higher education). Program-to-occupation matrices are derived from follow-up data for secondary and postsecondary vocational students. Considerable attention has been paid to generating accurate withdrawal data for selected occupations. Projected employment information by occupation and by industry is currently being developed. The Bureau of Information Systems within the State Department of Education is responsible for administration of the system; annual operating costs are not finalized at this time. However, an estimated $17,000 was calculated for personnel salaries in FY 1973, bringing costs roughly into line with the two systems for which such data are available in this section.

System output is not only in a format amenable to use in vocational education planning, but, more recently, research reports have been prepared concerning a number of occupations requiring baccalaureate or professional degrees.

FINANCIAL ACCOUNTING AND RESOURCE ALLOCATION SYSTEMS

1. Resource Allocation Subsystems in the New Jersey State Education Agency. Dr. E. H. Weiss.

Overview. Due to slowed early progress in MIS development, there presently exists no integrated general MIS--though it is anticipated that it will have a high priority in the future. There are two main centers of management information processing within the State Education Agency in New Jersey: (1) the Division of Administration and Finance which is largely manual in its data handling; and (2) the Branch of Statistics in the Office of Management Information which relies on centralized data management and computerized procedures. The latter is known officially as the New Jersey Department of Education Management Information System. These two agencies cooperate but are developing separately. However,the two subsystems discussed in this paper are not within these two centers but are located elsewhere in the State Education Agency.

The two resource allocation subsystems of interest are lodged within the Vocational Education Division, and the Division of Field Services, Bureau of Adult Education respectively.

Overview of subsystems of interest. The vocational education resource allocation subsystem (SVEA-MIS) is used in the state's grants management of federally appropriated monies. The other subsystem determines the allocations to high school equivalency (HSE) projects. The purpose of the vocational education model is to decide which project applications to fund or not to fund, whereas the HSE subsystem purpose is to distribute money among just under 200 projects throughout the state intended to help those who did not complete high school to receive an equivalency diploma.

Relationship of subsystems to decision-makers. Both subsystems are presently of use exclusively to personnel within the SEA.

Operational description of subsystems. The two subsystems are dealt with in sequence.

1. Vocational education resource allocation subsystems (SVEA-MIS).

LEA requests for program funding are computer sorted against a data base of past projects and current applications, according to a set of criteria variables (e.g., LEA type, community type, local tax rates, etc.). Applications are weighted and rank-ordered. Reports are generated at various stages during this process, with principal output being the final listing of course applications indicating whether or not they have been approved. Further analysis can be applied to the approval data so generated, in order to explore fully the consequence range of policy implications.

2. High school equivalency allocation subsystem.

In order to ensure that needs are adequately met, virtually all applications are funded under this system. The purpose then is to distribute existing monies equitably. Each program is assigned a base cost per hour adjusted on past data, and on a set of relevant criteria variables (LEA type, ethnic composition, etc.). Total costs are then prorated by state and local shares, and overall reports are produced and communicated to LEAs.

Direct costs are available for neither of these subsystems, though the author points out that there may be more than just financial costs to consider in systems of this kind.

2. Information for Public Education, Wyoming's Finance Subsystem. Dr. Mark M. Fox.

Overview. Wyoming's MIS, and specifically the financial subsystem, is an outgrowth of two studies conducted for the State Department of Education. The efforts of the contractors of these studies were coordinated under the Division of Planning, Evaluation and Information Services in the State Department of Education, and initiated (1) a management information system with five subsystems, and (2) a new program-oriented budgeting and accounting system throughout all Wyoming school districts. The MIS has as its objectives the systematic and uniform collection of local education agency data to enable improvements in local long-range planning.

Overview of subsystem of interest. In keeping with USOE emphasis towards program-oriented budgeting practices, Wyoming's finance subsystem was developed for the purpose of standardizing accounting procedures to have both compatibility with the national system and practicability for local district long-range planning.

Relationship of subsystem to decision-makers. The author discusses at length some general issues pertaining to the design of MIS with decision-makers in mind. The output of the finance subsystem is of primary interest to state and local education administrators, board members, legislators and taxpayers.

Operational description of the subsystem. Accounting systems are required to go down to the fourth level of specificity according to the new USOE handbook, i.e., down to subprograms, and cost-out expenditures through respective objects associated with program areas. LEAs, especially some of the larger school districts, are in the process of extending their accounting down to the course level (Level VI). Costs of the system are not given.

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